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NEW HORIZONS IN RADIOTHERAPY OF MALIGNANT DISEASE

Henry S. Kaplan, M.D., Stanford, Calif.

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Significant among indications that we stand at the threshold of a new scientific era in radiotherapy are, first, evidence of a greater spirit of cooperation and mutual respect between surgeons and radiotherapists and, second, the availability of new sources of high-energy radiation and more precise methods of dosimetry. Fundamental laboratory studies now in progress in the field of cellular radiobiology may open the way to even more exciting practical results. Of special significance in this respect are new methods of cell culture, which should aid in the estimation of radiosensitivity of different classes of cells, and measures designed to eliminate differences in oxygenation in normal and neoplastic cells. It may be expected that radiation treatment will become still more rational and significantly wider in scope within the next decade or two.

MODERN radiotherapy rests on a three-legged base comprised of clinical medicine, radiologic physics, and radiation biology. The radiotherapist must above all else be a physician, with a thorough grounding in the natural history of cancer, good clinical judgment, and humanitarian compassion for his patients. These are qualities that good therapists have had for many years, however, and we must therefore look elsewhere to explain the fact that radiotherapy for malignant disease is today in a phase of dynamic change which holds much promise for the future. There is presented herein a summary of certain recent trends and developments which are contributing to sustained progress in this field.

At the clinical level, one of the most encouraging elements is a new spirit of cooperation and mutual respect between surgeons and radiotherapists. Vitally important initial decisions on definitive treatment for patients with potentially curable cancer are more often made on a joint consultative basis, which makes it more likely that the patient will get the best form of treatment for his particular problem. Selection of an optimal treatment plan for each patient would be materially aided by the availability of better statistics on the end-results of treatment by different methods. The value of such data in turn is dependent on the proper staging and reporting of cancer of various primary sites. The League of Nations classification for carcinoma of the cervix, established many years ago, has been an invaluable aid in providing a

Professor and Executive, Department of Radiology, Stanford University School of Medicine.

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single standard for the evaluation of extent of disease by participating institutions all over the world. As a consequence, valid comparisons of the end-results of treatment by a variety of techniques have been possible through the years. There is a great need for the establishment of practical, convenient, and workable classifications for the staging of other primary sites and for uniform

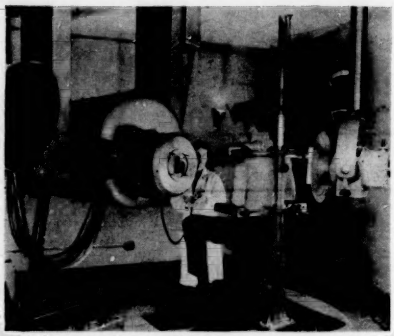

Fig. 1.—Six-Mev linear electron accelerator, illustrating typical setup for horizontal-beam rotation therapy of intrathoracic neoplasm. Beam localization may be precisely monitored with aid of auxiliary 150-kvp. x-ray tube mounted to provide virtual target behind lead collimator and of ceiling-mounted image amplifier on other side of rotating chair.

reporting procedures which will make the end-results of treatment for cancer of these various sites more directly comparable.

At the administrative and institutional level, there is a need to face the problem of centralization of radiotherapeutic care for the patient with radiocurable cancer. Although palliative therapy can be carried out satisfactorily by most general radiologists, the experience of many European radiotherapy centers indicates that the patient with radiocurable cancer has the best chance for cure in cancer centers staffed by well-trained physicians who limit their practice to full-time radiotherapy. In the United States, treatment of small numbers of such patients by each of many hundreds of general radiologists has the twofold disadvantage of depriving some patients of at least a small fraction of whatever chance for cure they might otherwise have had and of making it difficult or impossible for the larger centers to accumulate enough case material in any one category to provide early and decisive answers to a host of clinical questions.

Sources of High-Energy Radiations

Advances in radiologic physics have now provided us with a variety of new sources of high-energy radiations and with more precise methods of dosimetry. I should like to stress that the availability of high-energy machines or three-dimensional isodose patterns is not a substitute for but a supplement to the thoroughly well-trained and experienced clinical radiotherapist.

Currently available high-energy apparatus includes (*a*) the older van de Graaff and resonance transformer machines, both providing a peak x-ray energy of about 2 Mev; (*b*) cobalt-60 teletherapy units, whose gamma-ray beams have an energy equivalent to that of a 3-Mev-peak x-ray machine; (*c*) linear accelerators[1] (fig. 1), which produce 4 to 6 Mev x-rays; and (*d*) betatrons, which generate x-rays with peak energies of 15 to 30 Mev. While there are economic and other considerations which could dictate a preference by the radiotherapist for one or another of these devices in any particular installation, the important point to the medical profession at large is that the x-ray or gamma-ray beams from any of these devices have significant physical advantages over those of conventional 200-kv. therapy apparatus. Some of these physical advantages may be inferred from a comparison of the isodose curves of 200-kv. and supervoltage apparatus. From this it will be seen that, whereas the highest dose at conventional energies is always on the skin surface, the peak dose for

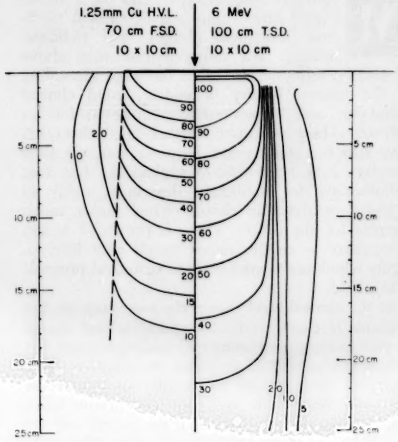

Fig. 2.—Comparison of isodose curves of 6-Mev and conventional 200-kvp. x-ray beams, illustrating greater depth dose, sharper beam edge, and low entrance skin dose which characterize supervoltage beam. (H.V.L., half-value layer; F.S.D., focal-skin distance; T.S.D., target-skin distance.)

supervoltage beams will be at some depth below the skin (fig. 2). Thus, the skin effect with supervoltage therapy can be so minimal as to be clinically inapparent. Second, the edge of the super-

voltage beam remains sharp as it penetrates deep into tissue, and it is thus possible to avoid vital structures which would necessarily be included in the broader scatter of the conventional beam (fig. 3 and 4). Third, the considerably greater penetration of the supervoltage beam makes it possible to deliver tumoricidal doses to deep-seated neoplasms even in obese persons. This is often difficult and sometimes impossible with conventional apparatus. A final important advantage of supervoltage beams is that they exhibit little or no differential absorption in bone. Tumors lying in close proximity to bony structures can therefore be irradiated to tumoricidal levels with little hazard of osteoradionecrosis (fig. 5).

Still other physical advantages are offered by high-energy particulate radiations, notably cyclotron deuterons and protons, such as have been used recently in experimental radiation hypophysectomy for metastatic malignant disease, and high-energy electrons generated by betatrons or linear accelerators. With particulate radiations it is theoretically possible to confine the radiation rather sharply to the tumor volume to be treated. The

Fig. 3.—Precise beam localization for rotation therapy of pituitary adenoma. Full lateral film is made with patient in treatment position, with use of 150-kvp. auxiliary tube and collimator then adjusted as for actual treatment before double exposure is made with 6-Mev beam. By prior fluoroscopy, metal ring has been located over entrance field and metal cross over central exit point; film establishes satisfactory adjustment.

enormous cost of the cyclotrons required for generating heavy particles of adequate energies has precluded the widespread trial of such beams. Current trials in at least four centers in the United States, though still preliminary, suggest that high-energy electron beams may prove to have a wider sphere of clinical usefulness.

Methods of Dosimetry

Precise knowledge of dose distribution in and around an irradiated tumor becomes even more important with supervoltage beams than with con-

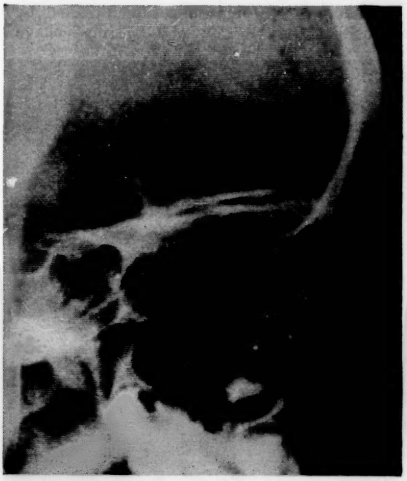

Fig. 4.—Double-exposure localization film made in position for treatment of retinoblastoma. Anesthetized infant is in supine position. Plastic cup bearing small lead markers has been placed over cornea, with posterior-most markers at limbus. Auxiliary collimators are used anteriorly to cover as much of posterior chamber as possible without irradiating lens.

ventional 200-kv. x-rays, where skin reaction can serve as some sort of clinical guide to the radiotherapist. Well-trained physicists and dosimetrists have techniques at their disposal today which make it possible to provide detailed information about dose in various planes in and about a tumor.[2] Careful plotting of dose distribution where multiple fields are employed is essential to avoid unsuspected "hot spots" and thus to minimize necrosis and complications and to detect "cold spots" in which undertreated tumor can persist and recur. No modern radiotherapy department today can afford to be without the services of a radiologic physics group. The need for such additional staff members, as well as the high cost of the various supervoltage devices, constitutes a further argument in favor of centralization of radiotherapeutic facilities.

Survival Figures

Such new tools and techniques might have been expected to reveal their superiority very quickly in terms of better survival figures. However, many factors complicate the situation and have until recently frustrated attempts at objective evaluation. Many years are required to build up series of cases of cancer arising at any one site, with roughly equal numbers of comparable extent treated by conventional x-ray therapy and by supervoltage techniques. There must then be sufficiently long follow-up to give some acceptable index of success or failure of the treatment. Since many of the patients will inevitably be of advanced age, there is always an appreciable attrition, even in the successfully treated cases, due to intercurrent disease or the development of a second primary cancer. Moreover, particularly in the more advanced cases, remote metastasis may cause the death of patients whose cancer at the primary site, or in the regional lymph nodes, has been eradicated.

Recently, Fletcher and his associates [3] have presented a detailed analysis, based on a practical and easily applied classification scheme, of the end-results of conventional versus supervoltage therapy for cancers of several sites in the oral cavity and pharynx. Metastasis and intercurrent disease accounted for a greater proportion of deaths among the patients treated with supervoltage radiation. One cannot expect the change in x-ray energy per se to alter the biology of the cancer, however; the treatment or prevention of metastasis is a separate problem which should not be permitted to cloud the issue posed here. Data on control of the primary cancer, summarized for three sites in the table, convincingly establish that supervoltage beams can eradicate deep-seated cancers significantly more often than conventional x-ray therapy.

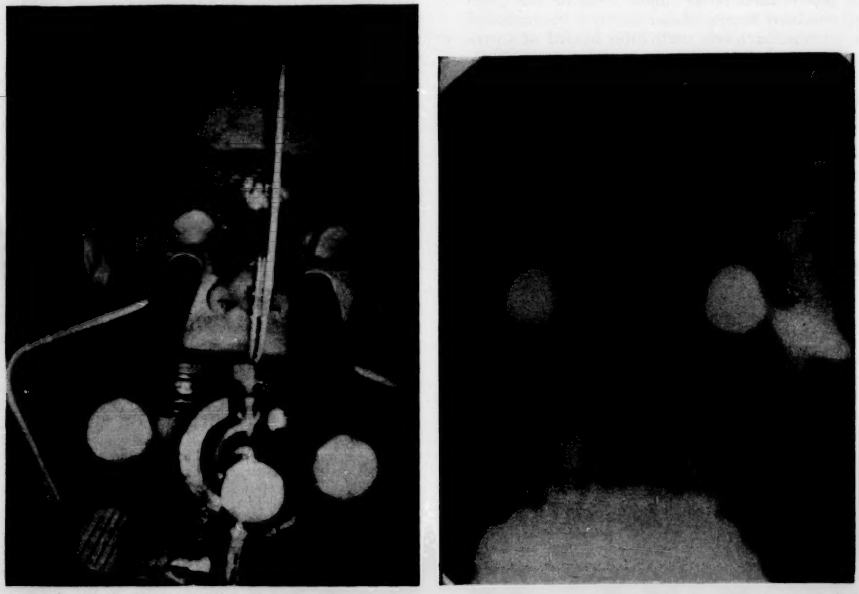

Fig. 5.—Setup (*left*) and localization film (*right*) for treatment of extensive carcinoma arising in ethmoid sinuses and invading both orbits, sphenoid, and subcutaneous tissues of nose. Wax build-up was used to increase skin dose in areas thought to be superficially infiltrated. Steel rods 8 in. long were aligned axially in beam to protect cornea and lens of each eye while entire orbit was irradiated. Dose in posterior orbits and sphenoid was supplemented with small lateral fields. Patient is alive and well 32 months after treatment, which delivered minimum of 6,000 rads in six weeks throughout tumor volume.

Cellular Radiobiology

Let us turn now to cellular radiobiology, where fundamental laboratory studies now in progress may open the way to even more exciting practical results. Limitations of space necessitate the selection of only a few of the more promising areas of current investigation and thought for discussion. Those interested in a broader treatment of the subject will find recent reviews helpful.[4]

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The basic mechanisms by which radiation kills cells are still not fully elucidated. The most sensitive indicator of radiation damage to the cell is its mitotic apparatus. Cells which go into mitosis soon after radiation will reveal the damage which they have sustained earlier and more impressively than other cells which divide sluggishly or not at all. A transient mitotic inhibition is seen after small doses of radiation but is readily repaired and would therefore seem not to be the basic mechanism of lethal damage. Slightly larger doses produce damage to chromosomes, often with the fusion of two or more broken chromosomes to form abnormal unions. Such chromosomal lesions are likely to lead to multipolar or otherwise abnormal mitoses and to produce daughter cells which are genetically deficient and nonviable. Heavily irradiated cells may be incapable of dividing again. They continue to make protein and other cell constituents, gradually enlarging to become giant cells,[5] and yet they are unable to initiate mitosis and presumably die when they finally attempt to do so. The mechanism of this effect is still not clear, though there is now some evidence to implicate radiation injury to the nucleolus.[6]

Much attention has been focused on the synthesis of the major nucleic acid constituent of the chromosome, desoxyribonucleic acid, or DNA. The inhibition of synthesis of DNA after radiation has long been known and was for a time considered a possible cause of the cell's inability to divide. More recently, however, a variety of studies have revealed that DNA synthesis may continue despite the fact that mitosis is inhibited.[7] This would indicate that impairment of DNA synthesis is not the primary mechanism of cellular damage, although the possibility cannot be excluded that damage to specific molecular species of DNA might introduce imbalances in the mitotic process, preventing subsequent cell division. That protein synthesis may play a role is indicated by the work of Wolff,[8] who recently found that protein synthesis inhibitors such as chloramphenicol can prevent repair of radiation-induced chromosome breaks and thus increase the net yield of abnormal chromosomes produced by a given dose of radiation.

Another development of considerable potential importance to the radiotherapist is the new method of cell culture devised by Puck and Marcus,[5] in which human cells plated out in Petri dishes divide to form visible colonies, each derived from a single cell. Thus, the reproductive potential of individual cells can be assessed, and this is precisely the kind of information which we most need to have about cellular radiation injury. Preliminary investigations by Puck and others with this method indicate that it will provide highly precise indexes of the radiosensitivity of different classes of cells in vitro. As these techniques are perfected, it may well become possible to take biopsy specimens of human tumors and to grow a portion of the biopsy material directly in vitro. It is not too fanciful to suppose that such cultures might then be tested for their sensitivity to radiation and a rational estimate of the correct tumoricidal dose for each patient be made on the basis of the response of his own tumor cells.

It has been known for a number of years that the radiosensitivity of many biological systems is critically dependent on the availability of dissolved oxygen. However, it remained for Gray and his associates[9] to point up the potential significance of local hypoxia or anoxia as a factor in radiotherapeutic failures. Many tumors outgrow their blood supply and exhibit focal areas of necrosis, at the borders of which cells of jeopardized viability exist in a state of hypoxia or anoxia.[10] On the basis of a number of experimental studies, it would appear that such cells would be from two to three times as radioresistant as those in well-vascularized portions of the tumor. Radiation doses adequate to destroy all of the well-oxygenated cells would thus be inadequate to eliminate cells that were hypoxic during irradiation, and these cells might serve as foci for recrudescence of the cancer.

*Control of Primary Disease by Orthovoltage and Supervoltage Therapy**

Primary Site	Orthovoltage		Supervoltage	
	No.	%	No.	%
Pharyngeal walls	2/9	22	12/16	75
Base of tongue	8/24	33	22/32	68
Tonsils	9/25	36	18/26	70
Totals†	19/58	33	52/74	70

* Data from Fletcher and others.[3]
† Difference of 37% is greater than 3 times the standard error of 3.5% and is therefore highly significant.

The oxygen effect reaches a plateau at tensions of about 40 mm. Hg, which is the prevailing oxygen tension at the venous end of the capillaries in normal tissues. Thus, increasing the oxygen tension throughout the body would have relatively little effect on the radiosensitivity of the normal tissues or of the well-oxygenated tumor cells. The essential problem is the elimination of differences in oxygenation of normal and tumor cells; this can be accomplished either by increasing the oxygen level of the hypoxic tumor cells or by decreasing the levels in the normal tissues to those prevailing in the hypoxic zones of the tumor.

The first approach requires use of pure oxygen under 3 atmospheres or more of pressure. A clinical trial with high-pressure oxygen has been in progress for a few years in England under the direction of Churchill-Davidson.[11] Although preliminary results have been somewhat encouraging, the method is so cumbersome that the accumulation of adequate numbers of cases to provide statistically convincing results will require a long time.

Wright [12] has pointed out the possibility of inducing anoxia to achieve the same end-result, namely, the elimination of differences in oxygenation between normal and neoplastic tissues. While total anoxia appears to be associated with an excessive hazard, experiments currently in progress indicate that significant benefit might be conferred by the induction of tolerable levels of hypoxia. If current trials with hypoxia in tumor-bearing animals prove successful, this should prove to be a practical and much more widely applicable method than high-pressure oxygen. The inert gases and nitrous oxide appear to influence the oxygen effect in plants,[13] but little evidence of their action has been observed in animal studies.

Finally, the possibility that radiosensitivity of cells can be selectively modified by pretreatment with chemical sensitizers has begun to receive serious attention in a number of laboratories. Although early clinical and experimental trials have given variable results,[14] more refined techniques such as the Puck tissue-culture system may enable the detection of synergistic effects of chemical agents and radiation. Effective chemical agents would offer the exciting clinical potentiality of differentially enhancing the radiosensitivity of previously refractory or inadequately radioresponsive types of neoplasms.

Comment

From this rather brief summary it is apparent that we stand at the threshold of a new scientific era in radiotherapy in which we may well see advances fully comparable to those which the field has already made in its brief 60 years of largely empirical development. These advances should be substantially reflected in the end-results of radiotherapy during the next decade or two and may also be expected to make treatment with this method more rational and significantly wider in scope.

Stanford University Medical Center, Palo Alto, Calif.

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DECLINE OF INVALIDISM IN OLD PEOPLE.—The increasing number of old people tends to augment the number of physical and mental invalids in the community. Yet the view that medicine is artificially fostering the survival of aged people who are no longer able to play any useful role in society has very little foundation. Although an increase in the rate of invalidism may be reasonably expected in the future in countries with a growing proportion of aged population groups, the evidence which has been made available to the committee from Sweden suggests that the expected increase there in the proportion of invalids in old age have been more than offset by social and medical progress. The proportion of invalids in old age in Sweden has shown a progressive decline during the past three or four decades.—Report: Mental Health Problems of Aging and the Aged, *World Health Organization Technical Report Series*, 1959.

RESPIRATORY PARALYSIS AND SEVERE POTASSIUM DEPLETION AFTER URETEROSIGMOIDOSTOMY

Ralph A. Straffon, M.D.
and
Alton J. Coppridge, M.D., Ann Arbor, Mich.

Similarity of the potassium-depletion syndrome of extreme muscular weakness and respiratory paralysis to neurological disease is striking and may result in initial diagnostic error. In the cases reported, admission diagnosis was possible poliomyelitis or subacute metallic poisoning in one and Landry's acute ascending myelitis in the other. Potassium replacement measures produced prompt improvement in both patients. Contributing to the severe potassium depletion, which was perhaps in part related to the ureterosigmoidostomy, was decreased intake as a result of earlier anorexia, nausea, and vomiting in both patients.

Muscular weakness progressing to respiratory paralysis is most frequently associated with neurological disorders. In recent years hypopotassemia (hypokalemia) associated with ureterosigmoidostomy has been reported by several authors. In 1951 Diefenbach and associates [1] described a patient with hypopotassemia after bilateral ureterosigmoidostomy who developed a complete flaccid paralysis; since this initial report several additional cases have appeared in the literature.[2]

Recently, two patients with ureterosigmoid anastomosis who presented with marked muscular weakness rapidly progressing to respiratory paralysis were seen at the University of Michigan Hospital. Because of the presenting symptoms both patients were originally felt to have neurological disorders. One of these, a child, initially was suspected of having poliomyelitis while the other, an adult, was admitted with a diagnosis of Landry's acute ascending myelitis. It was not until serum electrolyte determinations were obtained that the true etiology of the paralyses was suspected. To our knowledge this complication has not been previously reported in patients with ureterosigmoidostomy.

Report of Cases

CASE 1.—A 12-year-old girl was first seen at the University of Michigan Hospital on Nov. 21, 1955, with extreme muscular weakness, nausea, and vomiting. Three days prior to admission the patient noted the onset of malaise and weakness of the legs and back, followed by nausea and vomiting. Twelve hours prior to admission the patient was unable to sit, raise her head, or feed herself. There was no fever, diarrhea, or associated upper respiratory symptoms. The patient's medical history revealed that at the age of 6 years she had had a cystectomy and a ureterosigmoid anastomosis for exstrophy of the bladder. She had done well until she was 10 years old, when she developed frequent episodes of urinary tract infection characterized by flank pain, fever, nausea, and vomiting. There had been no previous episodes of weakness.

Physical examination at the time of admission revealed a well-developed girl who appeared acutely ill. She was breathing chiefly by abdominal musculature at a rate of 28 respirations per minute. She was alert, flushed, but afebrile, and her blood pressure was 165/65 mm. Hg. The neurological examination revealed a flaccid paralysis, with diminished to absent deep reflexes bilaterally. All the cranial nerves were intact and the sensory examination was normal. The remainder of the physical examination was not remarkable.

The initial diagnosis was "progressive muscular weakness of unknown etiology," poliomyelitis and subacute intoxication (with lead or arsenic) being considered. Determinations of serum electrolyte levels were obtained, but before the results were available the patient became cyanotic and unresponsive; she was placed in a tank respirator, with immediate relief of her cyanosis. When the presence of hypopotassemia was recognized the patient was started on therapy with potassium chloride, given both intravenously and orally. An electrocardiogram at this time confirmed the findings of severe potassium depletion.

Table 1 shows the findings of the electrolyte studies and the patient's response to therapy with potassium chloride. The response to administration of potassium was dramatic. Within several hours the patient was removed from the respirator and was sitting up in bed. Her hospital course was uneventful, except for a febrile episode felt to be due to a urinary tract infection which responded to antibiotic therapy. The patient was discharged on Dec.

From the Section of Urology, Department of Surgery, University of Michigan Hospital. Dr. Straffon is now a member of the staff of the Department of Urology, the Cleveland Clinic Foundation and the Frank E. Bunts Educational Institute. Dr. Coppridge is now a member of the staff of Watts Hospital, Durham, N. C.

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2, 1955, and has been followed up in the outpatient department. She has had no further difficulty to date.

CASE 2.—A 56-year-old man was first seen at the University of Michigan Hospital on June 30, 1958, with a flaccid paralysis and in severe respiratory distress. His history revealed that about two weeks prior to admission he noted the onset of anorexia, nausea, and vomiting. Subsequently he noted muscular weakness beginning in the lower extremities and progressing in an ascending manner. The day prior to admission he was unable to walk, feed himself, or cough. He was transferred to the University of Michigan Hospital to be placed in a respirator because of his respiratory distress. The patient's medical history revealed that in 1944 he had had a cystectomy and ureterosigmoid transplants because of complications resulting from an automobile accident in 1927.

Physical examination at the time of admission revealed an acutely ill man with rapid, shallow respirations. He was afebrile and normotensive. The neurological examination revealed a generalized flaccid paralysis, with absent deep and superficial reflexes. The cranial nerves were intact and the sensory examination was normal. The remainder of the physical examination was not remarkable.

The patient was admitted to the neurology service with an initial diagnosis of acute ascending paralysis and was immediately placed in a respirator. The patient's vital capacity at the time he was placed in the respirator was 800 cc. Results of a neostigmine (Prostigmin) test to rule out myasthenia gravis were negative. Lumbar puncture revealed a normal pressure and the only abnormality of the spinal fluid was a protein level of 150 mg.%. Determinations of serum electrolyte levels revealed a severe hypopotassemia, which was confirmed by the electrocardiogram. Table 2 shows the findings of the initial electrolyte studies and the patient's response to therapy.

After being placed in the respirator the patient became hypotensive and required the administration of vasopressors to maintain his blood pressure. He was noted to be oliguric at this time. When his serum potassium level was discovered to be low, intravenous administration of potassium chloride was begun. His response to this therapy was remarkable, and by the next day the patient was normotensive, his vital capacity had increased to 2,400 cc., and he was able to breathe without the respirator. Potassium was administered cautiously in view of the patient's elevated blood urea nitrogen level and the presence of oliguria. The remainder of his hospital course was one of progressive improvement. Urine output gradually increased and the blood urea nitrogen level fell slowly. On July 16, 1958, the patient was discharged on a regimen of Shohl's solution (sodium citrate and citric acid in water) and potassium supplements.

Comment

The two cases presented above illustrate neurological findings which may be seen in poliomyelitis, Landry's acute ascending myelitis, and familial periodic paralysis due to hypopotassemia. Flaccid paralysis due to hypopotassemia has also been observed in the following instances: the recovery phase of diabetic coma; thyrotoxicosis; porphyrinuria; the Fanconi syndrome; potassium-losing nephritis; the diuretic phase of acute renal failure; the chronic use of cathartics; primary aldosteronism; and after ureterosigmoid transplants.[3] The paralysis produced by hypopotassemia is a flaccid one, with diminished or absent deep reflexes but with normal sensation. The electromyogram shows that the muscle is inexcitable either directly or through its nerve.

TABLE 1.—*Findings of Electrolyte Studies and Patient's Response to Therapy*

	Electrolyte Levels							
Date, 1955	Sodium, mEq. per Liter	Potassium, mEq. per Liter	Carbon Dioxide, mEq. per Liter	Chloride, mEq. per Liter	Blood Urea Nitrogen, Mg. %	pH	Treatment	Progress
11/22.....	150	2.3	8.8	111	132	7.18	(11 p.m.) 3.0 Gm. of potassium chloride	Flaccid paralysis; put in respirator
11/23.....	140	2.0	10.4	112	167	7.34	4.5 Gm. of potassium chloride	Dramatic response; out of respirator
11/25.....	141	3.5	16.7	109	133	7.37	6.0 Gm. of sodium bicarbonate and Randall's solution*	Ambulatory; became febrile
11/28.....	...	...	26.2	100	75	7.55	As above	Still febrile; pyelonephritis treated with antibiotics
11/30.....	150	4.3	27.4	108	54	7.46	As above	Doing well

* Contains one part each of potassium acetate, potassium bicarbonate, and potassium citrate in distilled water.

The patient's vital capacity and the blood urea nitrogen level fell slowly. On July 16, 1958, the patient was discharged on a regimen of Shohl's solution (sodium citrate and citric acid in water) and potassium supplements.

Grob and his associates,[4] studying the effects of potassium on muscle function in patients with familial periodic paralysis, noted at least three abnormalities during the period of hypopotassemia: (1) a decrease in the response to nerve stimulation, (2) a reduction in the spread of the excitation wave, and (3) a decrease in contractility. There is an increase in the ratio of intracellular to extracellular potassium and this hyperpolarization is felt to be the cause of the decreased responsiveness of the muscle to stimulation.[5]

Hyperchloremic acidosis as a complication of ureterosigmoid transplantation was first described by Boyd[6] in 1931. In 1950 Ferris and Odel[7] reported on a series of 141 patients with ureterosigmoidostomy and found hyperchloremic acidosis in 79%. These authors, in addition to others,[8] felt that the hyperchloremic acidosis was due to the re-

absorption of urinary constituents from the colon, chloride reabsorption being greater than that of sodium. More recent work suggests that sodium and chloride are reabsorbed in approximately equal amounts, although this would still produce a relative hyperchloremia.[9]

In 1951 Lapides,[10] noting the late development of hyperchloremic acidosis in some patients and its failure to develop at all in others, stated that, although absorption of urinary constituents occurred constantly, hyperchloremic acidosis did not occur unless renal function was impaired. He suggested that the renal lesion was produced by recurrent bouts of pyelonephritis and might be similar to that seen in renal tubular acidosis. The lowered incidence of pyelonephritis reported by Leadbetter and Clarke[11] with use of their "combined" technique was associated with a low incidence of hyperchloremic acidosis, which would tend to confirm the observations of Lapides.[10]

Hyperchloremic acidosis with potassium depletion is also seen in cases of renal tubular acidosis. Although the etiology of this lesion is not well understood it is often associated with pyelonephritis. In this syndrome[12] there is a basic inability to excrete an acid urine, which is probably due to decreased hydrogen ion secretion in the distal tubule, conservation of the fixed base being impaired. The distal tubular secretion of potassium increases in an attempt to offset the depression of hydrogen ion secretion but does not compensate completely. Hence, increased amounts of sodium, calcium, and potassium are excreted in the urine. With the loss of sodium ions in the urine the serum concentration of sodium is depressed. The sodium depression reduces the stimulus to the osmoregulatory system which is manifested by a suppression of antidiuretic hormone, producing a polyuria in an attempt to maintain osmolarity. Consequent to the increased loss of fluid a contraction of extracellular fluid volume, as well as intravascular volume, is produced. As this contraction reaches a critical point the volume-control system is brought into action to maintain the extracellular fluid volume. This contraction of plasma volume is a potent stimulus to aldosterone production which, in turn, increases the reabsorption of filtered sodium by the kidney accompanied by equal amounts of chloride. This results in a relative hyperchloremia, in addition to the associated potassium loss. These electrolyte abnormalities are similar to those seen in patients with hyperchloremic acidosis after ureterosigmoid transplants. The only evidence in the literature to date which suggests that this lesion may not be present in patients with ureterosigmoidostomy is the report by Rosenberg,[8] who found an acid urine in a small group of patients and dogs. This finding would be incompatible with a lesion of the acidifying mechanism present in renal tubular acidosis.

According to a recently published study by Stamey,[13] hyperchloremic acidosis was produced in a patient with reportedly normal renal function by administration of continuous urine enemas. On the basis of this study Stamey felt that hyperchloremic acidosis could occur in the presence of normal renal function. He postulated a renal loss of potassium unrelated to a lesion of the base-conserving mechanism and, in addition, a colonic loss of potassium. D'Agostino and associates[8a] have demonstrated a colonic loss of potassium in dogs by infusion of saline solution into an isolated colonic segment.

TABLE 2.—*Findings of Electrolyte Studies and Patient's Response to Therapy*

Date, 1955	Electrolyte Levels: Sodium, mEq. per Liter	Potassium, mEq. per Liter	Carbon Dioxide, mEq. per Liter	Chloride, mEq. per Liter	Blood Urea Nitrogen, Mg. %	pH	Treatment	Progress
6/30.....	136	1.6	6	111	66	6.94	1.2 Gm. of potassium chloride	Flaccid paralysis; put in respirator
7/ 1.....	130	1.6	7	124	...	...	6.0 Gm. of potassium chloride	Vital capacity of 800 cc.; hypotensive
7/ 2.....	132	1.9	8	109	...	...	12.0 Gm. of potassium chloride	Normotensive; out of respirator; vital capacity of 2,400 cc.
7/ 3.....	136	3.4	12	110	99	...	No potassium chloride	Marked increase in strength
7/ 7.....	140	4.2	9	109	186	...	4.0 Gm. of potassium chloride and Shohl's solution	Ambulatory
7/11.....	145	3.2	14	116	148	...	As above	Doing well

The severe potassium depletion seen in the cases reported in this study was undoubtedly due to a combination of factors. The renal loss of potassium is well documented in the literature, but the lesion responsible for this loss needs further definition. Whether this is a result of renal tubular acidosis, chronic renal disease secondary to pyelonephritis, or simply an osmotic diuresis remains to be proved. Colonic loss of potassium has been shown to occur experimentally, but the magnitude of this loss and its role in the development of clinical hypopotassemia also remains to be defined. Finally, what was probably the most important precipitating factor in the cases reported was the marked reduction in potassium intake which was due to the anorexia, nausea, and vomiting associated with hyperchloremic acidosis.

Summary

Although muscular weakness progressing to respiratory paralysis is most frequently associated with neurological disorders, two of our patients with

ureterosigmoid transplants and severe potassium depletion developed flaccid paralysis progressing to respiratory paralysis. To our knowledge this complication has not been previously reported. The similarity of this syndrome to neurological disease is striking and the mechanisms producing potassium depletion are various.

2020 E. 93rd St. (6) (Dr. Straffon).

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V. 1

USE OF A NEW VASODILATOR AGENT IN MANAGEMENT OF PERIPHERAL ARTERIAL INSUFFICIENCY

Saul S. Samuels, M.D.
and
Herbert E. Shaftel, M.D., New York

The usefulness of isoxsuprine hydrochloride as a dilator of peripheral blood vessels was studied in 46 patients with arteriosclerosis obliterans. Their ages ranged from 41 to 77 years, and gangrene was present in three. Objective evidence of improvement, in the form of increased walking distance, healing of gangrene, and oscillometric and plethysmographic data, was obtained in 39 patients. The isoxsuprine hydrochloride was given by mouth at dosages of 10 or 20 mg. three times a day for periods ranging from three weeks to 18 months. This dosage did not cause any untoward side-effects, and no contraindications were noted.

Vasodilator properties of a new hydroxyephedrine derivative, isoxsuprine (Vasodilan) hydrochloride, have been reported in detail.[1] The compound, known chemically as 1-(p-hydroxyphenyl)-2-(1'-methyl-2'-phenoxyethylamino)-1-propanol hydrochloride, was synthesized by Moed and Van Dijk.[2] It has been used as the hydrochloride in Europe and elsewhere, since 1955, for the production of peripheral vasodilatation in patients suffering from vascular insufficiency.

Apparently isoxsuprine acts directly on smooth muscle, with useful selectivity of action on blood vessels and the uterus, and some bronchodilator effect. It is not known whether isoxsuprine action is mediated through specific receptors or is nonspecific as to target in the smooth muscle cell. It seems

From the Department of Experimental Angiology, Stuyvesant Polyclinic.

clear, however, that the adrenergic blocking action of this drug is minor, clinically unimportant, and not essential to vasodilatation.

Isoxsuprine hydrochloride is rapidly and completely absorbed after oral administration.[3] In trained unanesthetized dogs, 10-50 mcg. per kilogram of body weight (intravenous) or 200-800 mcg. per kilogram (oral) doses cause only trivial and transient tachycardia. In addition to the effect on heart rate, isoxsuprine mildly increases contractile force of the heart,[4] as measured by the open-chest strain-gauge technique[5] in dogs. Extravascular smooth muscle actions of isoxsuprine include a potent uterine relaxant effect and some slight bronchodilator activity.[6]

Table 1.—*Objective Indications of Improvement Under Isoxsuprine Therapy in Patients with Arteriosclerosis Obliterans*

No. of Patients	Improvement Indicated by
18	Walking distance only
9	Walking distance and plethysmography
8	Walking distance and oscillometry
1	Oscillometry only
1	Healing of gangrene only
2	Healing of gangrene and oscillometry
39	Total objectively improved (84.8% of all cases)
7	Improvement not objectively demonstrated (15.2% of all cases)
46	Total cases studied

Kaindl and co-workers[7] first reported the clinical usefulness of isoxsuprine as a vasodilator. Their results indicate that isoxsuprine produces effective vasodilatation in patients with peripheral vascular insufficiency in doses which seldom cause tachycardia or significant hypotension. These authors showed further that isoxsuprine was effective when administered by oral, intramuscular, intravenous, or intra-arterial routes. The outstanding clinical results were improvement in intermittent claudication, relief of resting or night pain in the extremities, and decrease in trophic skin disturbances. Subsequent reports[8] have confirmed these findings.

The present study of isoxsuprine as a vasodilator in the management of peripheral arterial insufficiency has lasted for approximately one and one-half years. During this period related studies have been instituted, designed to investigate the effects of isoxsuprine on blood sugar and on requirements for hypoglycemia-producing drugs, and the use of isoxsuprine as a uterine relaxant. Results of these special studies will be published separately.

Material and Methods

Forty-six patients were studied. Their ages ranged from 41 to 77 (median, 63) years. Thirty were women. The diagnosis in each case was arteriosclerosis obliterans (in two cases diabetes mellitus also was present). All patients were treated with isoxsuprine hydrochloride orally, at dosages of 10 or 20 mg. (1 or 2 tablets) three times a day. Isoxsuprine therapy lasted from three weeks to 18 months (median, 7 months).

Objective criteria of improvement included walking capacity ("claudication distance") estimated in blocks, digital plethysmography, and oscillometry. In three patients the presence of gangrene afforded an additional index of effectiveness. Digital plethysmography was performed in eight patients as an acute test of the effects of subcutaneously administered isoxsuprine (5 mg.). Maximal response over a period of one hour was recorded. In these same patients, and in one additional case, plethysmography was performed at intervals over a period of several weeks, to determine the response to chronic oral therapy.

Results

The present report does not consider subjective improvement, such as relief of pain or cramps, or decreased sensations of cold, in the affected parts. Objective evidence of improvement during isoxsuprine therapy was obtained in 39 (about 85%) of the 46 patients studied. Objective indications of improvement are summarized in table 1, which shows that improvement could be demonstrated in 39 (about 85%) of the 46 patients.

Walking Capacity.—The maximum number of blocks that could be walked before the onset of severe, crippling ischemic pain was reported for 43 patients. In 37 (about 86%), the walking capacity was increased. In the entire group of 43 patients the mean walking capacity was 3.2 blocks before treatment and 7.8 blocks after treatment, an increase of about 144%. This is a conservative estimate of improvement, since four patients reported their post-treatment walking distance as "more than 6 blocks," "more than 8 blocks," and "no limit" (two patients), whereas these distances were scored as 6, 8, and 10 blocks respectively.

Table 2.—*Digital Blood Flow, as Estimated by Plethysmograph, Before and After Administration of Isoxsuprine Hydrochloride*

Case	Blood Flow, Cc. per Sec.			
	Finger		Toe	
	Before	After	Before	After
1	7.6	25.0	1.0	5.0
	11.0	17.0	5.0	4.0
2	11.0	14.0	1.5	2.5
3	11.5	18.5	1.0	5.0
4	2.5	4.0	1.5	6.0
5	9.0	13.0	0.5	1.0
	4.0	8.0	6.5	18.0
6	8.0	6.5	3.5	8.0
7	9.0	7.5	0.2	3.0
8	4.5	9.0	2.0	3.0
	16.0	18.0	14.0	14.5
Mean	8.5	12.8	3.3	6.5

Plethysmography.—The results of indirect estimation of blood flow in finger or toe, before and after subcutaneous administration of 5 mg. (1 ml.) of isoxsuprine hydrochloride, are given in table 2.

Blood flow to the finger after isoxsuprine administration increased by about 50%, on the average, while blood flow to the toe nearly doubled (increased 97%). It may be observed in table 2 that in two instances (cases 6 and 7) blood flow to the finger decreased slightly after isoxsuprine was administered, while in no case did blood flow to the toe decrease under these circumstances. It is noticeable also that blood flow to the toes was smaller at the outset than the flow to the fingers. This observation is consistent with the location of the arterial insufficiency in our patients: practically all had more severe symptoms in the legs than in the arms. Plethysmography performed at intervals during prolonged therapy with isoxsuprine, in general, confirmed the results of acute tests. The improvement in blood flow usually persisted for a week or longer when isoxsuprine was withheld.

Oscillometry.—Oscillometric estimates of blood flow in the leg are recorded for 15 patients. In nine of these there was an apparent increase in blood supply under isoxsuprine treatment, as summarized in table 3. On the average, isoxsuprine in these nine

TABLE 3.—*Effect of Isoxsuprine Hydrochloride on Blood Flow in the Leg, as Estimated Oscillometrically*

Case	Blood Flow, Cc.	
	Before	After
9.	0.0	0.6
10.	0.2	0.4
11.	0.3	2.0
12.	0.2	0.4
13.	1.0	1.2
14.	1.0	3.0
15.	1.0	8.0
16.	0.8	1.2
17.	1.1	2.0
Mean	0.6	2.1

patients caused an increase of about 250% in blood flow, as estimated oscillometrically. In no case did blood flow decrease, as measured by this method.

Healing of Gangrene.—Three patients with arteriosclerosis obliterans had gangrene of the lower extremity. With isoxsuprine therapy gangrene healed completely in two of these cases and was healing at the time this report was written in the third case.

Comment

Our results, in general, confirm those of the earlier investigators cited above who similarly observed increase in claudication distance and blood flow (estimated plethysmographically and oscillometrically as well as by other methods) when patients with peripheral vascular insufficiency were treated with isoxsuprine. We did not observe, on either subcutaneous or oral dosage with isoxsuprine, any troublesome or distressing side-effect. Decrease in arterial pressure or increase in heart rate, if it occurred, was slight and transient, did not make the patient uncomfortable, and did not merit recording as a significant untoward effect.

We observed no phenomenon which would suggest the existence of contraindications to use of isoxsuprine hydrochloride. Two of our patients reported here were diabetic. In these we could detect no effect of isoxsuprine on blood sugar level, or on requirements for insulin or tolbutamide. Observations in a larger series of diabetic patients will be reported elsewhere.

The "borrowing and lending" phenomenon, in which (it has been suggested) vasodilating agents may increase the caliber principally of healthy vessels and thereby rob rather than replenish the blood supply of ischemic tissues, evidently did not operate under conditions of the present study. Nearly all of our patients were ischemic in the legs and had normal or relatively normal blood flow in the upper extremities. As summarized in table 2, isoxsuprine, on the average, increased blood flow proportionately more in the legs than in the arms.

Since isoxsuprine hydrochloride effectively dilates peripheral blood vessels without distressing side-effects (when administered as recommended), it should be well suited to outpatient and office management of peripheral vascular disease.

Summary

Isoxsuprine hydrochloride was administered orally for a median period of seven months to 46 patients suffering from arteriosclerosis obliterans. Objective improvement could be demonstrated in 39 (about 85%) of these. There were no significant side-effects or phenomena suggestive of the existence of contraindications. The drug seems well suited to outpatient or office management of peripheral vascular diseases.

151 E. 83rd St. (28) (Dr. Samuels).

The isoxsuprine hydrochloride used in this study was supplied as Vasodilan hydrochloride by Mead Johnson & Company, Evansville, Ind.

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EVALUATION OF DISABILITY IN COAL MINERS WITH CHRONIC PULMONARY DISEASE

William H. Anderson, M.D.
and
William F. Schmidt, M.D., Harlan, Ky.

At the present time the maximum breathing capacity test provides the most significant correlation between symptoms and history of ability to work without pulmonary symptoms, as compared with the vital capacity or three-second timed vital capacity tests. As a study that can be readily performed in the general hospital or physician's office, it offers the most practicable objective guide to evaluation of dyspnea in relation to hard manual labor in coal mining. This conclusion is based on studies carried out in 482 persons, most of whom were soft-coal miners, divided into seven groups by varying degrees of breathlessness in association with physical activity. Similar studies should be done to serve as disability guides for other groups of workers.

The need for criteria of disability in patients with chronic pulmonary disease is obvious, when one considers the many changes in workmen's compensation laws, recent changes in the Social Security Act, and the present lack of criteria for disability in persons with this group of diseases.

By chronic pulmonary disease we mean those conditions affecting the respiratory apparatus, exclusive of neoplasm, for which at present there are no curative treatments and which may therefore be expected to persist for the remainder of the patient's life. This terminology restricts us to pulmonary fibrosis due to a number of causes; pulmonary emphysema, loss of functioning tissue due to surgery, and bronchiectasis too extensive for resectional therapy. We are excluding curable infectious or suppurative disease. The term disability, as used in this paper, denotes an incapacity to perform a given work load because of the development of breathlessness. We wish specifically to differentiate dysfunction and disability. A man may have pulmonary dysfunction, but not to a disabling extent.[1] The appropriate work load should be specified when discussing disability. For example, a man who is disabled as a lumberjack may be perfectly able to perform the work of a bookkeeper or watch repairman, from the point of view of the energy expenditure for the type of work involved.

Ideally, it should be possible to evaluate the extent of disability in the average general hospital or physician's office. Such tests should require little equipment and time. Most of the work should be done by a technician, without the necessity of extensive specialized training. The test, or tests, should give repeatedly reliable results on the same person, be able to identify a malingerer, and provide a wide range of values between those persons with and those without symptoms of a disabling disease. The test should be specific for the parameter being tested. It should require no patient training and little or no patient cooperation.

Of the tests which can be done in a general hospital or in a physician's office the maximum breathing capacity, vital capacity, and three-second timed vital capacity tests have been most widely used. Since none of these three meets all criteria of the ideal test, all three were evaluated in this study. It is the purpose of this presentation to evaluate the maximum breathing capacity, vital capacity, and

Associate Chief of Medicine and Director of the Cardiopulmonary Laboratory, Harlan Memorial Hospital, Miners Memorial Hospital Association (Dr. Anderson), and Chief of Medicine, Norton Community Hospital, Norton, Va., and Attending Physician, Wise Memorial Hospital, Miners Memorial Hospital Association, Wise, Va. (Dr. Schmidt).

the three-second timed vital capacity tests as guides for the objective determination of disability in coal miners with chronic pulmonary disease.

Material and Methods

The subjects tested came from several sources: direct referrals from family physicians of both outpatients and hospitalized patients, indirect referrals for evaluation of the validity of a claim for compensation or social security benefits, and referrals from either the Virginia or the Kentucky divisions of vocational rehabilitation. Not all patients had pulmonary symptoms. Some physicians and hospital employees were also included in the study, but, since coal mining is the major industry in this region, most of the persons tested were coal miners.

TABLE 1.—*Age Distribution in Years of 482 Subjects Studied*

Group	20-29	30-39	40-49	50-59	60-69	Over 70
Hard work, asymptomatic	8	13	24	14	2	...
Hard work but breathless	1	8	26	27	3	...
Sedentary work, asymptomatic	21	6	3	1	2	...
Sedentary work but breathless	1	1	12	17	2	...
Unable to work because of breathlessness	...	4	4	120	59	2
Retired, asymptomatic	...	...	...	1	11	12
Retired but breathless	...	...	...	...	17	11

All patients with organic heart disease other than cor pulmonale were excluded from the study, as were those persons who were disabled for work due to other causes than pulmonary disease; as, for example, an injury in the mine due to a slate fall. These exclusions were made without knowledge of the results of the pulmonary function studies. All results of pulmonary function studies were then reviewed, and those which were technically unsatisfactory, because not consistently reliable within 5%, were also discarded. The charts were reviewed without knowledge of the results of the pulmonary function studies. On the basis of the patient's description of his work he was assigned to one of four work groups. These groups were further subdivided according to whether or not the patient complained of shortness of breath, either at rest or with exertion. Results of tests were repeatedly reliable in patients with this complaint, since they gave the same history from one time to another.

A man was assigned to the "hard work" group if he was able to carry out satisfactorily any duty in coal mining for a full shift of work, or, in our opinion, an equal work load. The sedentary work group included those men who were able to perform only the less strenuous aspects of a job and depended on their fellow workers to do the more difficult work, or those men who, because of pulmonary symptoms, had been given a job requiring less physical exertion. This group also included some men who no longer worked in mining but were able to manage a small garden plot or do certain jobs in a restaurant or store. The disabled group consisted of men who were no longer working and stated that the reason they stopped working was because they were too short of breath to continue. The retired group was made up of those men who had stopped working, not because of any physical impairment but because they had reached retirement age.

One of us used the 13½ liter Collins spirometer and the Gaensler-Collins Vitalometer; the other used the double-spirometer system of the Pulmotest (double spirometer for spirometric tests and bronchospirometric studies). We used the regression formula based on body surface area and age to estimate the predicted maximum breathing capacity. The formula based on height and age was used to estimate the predicted vital capacity.

Results

The 482 subjects studied were divided into the following seven groups: (1) hard work, asymptomatic; (2) hard work but breathless; (3) sedentary work, asymptomatic; (4) sedentary work but complains of shortness of breath; (5) unable to work because of breathlessness; (6) retired because patient reached retirement age, asymptomatic; and (7) retired because patient reached retirement age but complains of shortness of breath.

Table 1 indicates the age distribution in each group and table 2 indicates the number of years of employment in each group.

Results of the maximum breathing capacity test are given throughout this study as the percentage of the predicted normal value for age and body surface area. Vital capacity results are expressed as the percentage of the normal value predicted on the basis of age and height. The three-second vital capacity figures are given as a percentage of the total vital capacity in each instance. Expression of the results as a percentage of the predicted values permits a direct comparison of patients in different age groups on the basis of type of work or symptoms, since the regression formulas correct for decreasing function with age. However, if one again refers to table 1 it will be noted that the retired groups include the older subjects, while the younger subjects are in the sedentary work, asymptomatic, group. This is because most subjects in the latter group were hospital employees. The disabled subjects were predominantly in the 50-to-60-year age range, whereas those in the two groups still per-

TABLE 2.—*Number of Years of Employment of 482 Subjects Studied*

Group	1-9	10-19	20-29	30-39	40-49	50-59
Hard work, asymptomatic	8	19	16	9	2	...
Hard work but breathless	2	17	21	18	6	...
Sedentary work, asymptomatic	26	1	1	1	...	1
Sedentary work but breathless	...	3	6	10	3	1
Unable to work because of breathlessness	3	30	61	80	29	1
Retired, asymptomatic	...	1	3	7	9	3
Retired but breathless	...	...	2	7	12	1

forming hard work were predominantly in the age group of 40 to 60 years. The mean maximum breathing capacity, vital capacity, and three-second vital capacity figures for each group are shown in table 3.

TABLE 3.—*Mean Values and Standard Deviation for Pulmonary Function Tests in 482 Subjects**

Group	Maximum Breathing Capacity	Vital Capacity	Three-second Vital Capacity
Hard work, asymptomatic	89.8%± 9.1	98%± 4.7	92.4%± 6.1
Hard work but breathless	68.9%±17.2	93.5%±14.8	90.2%± 9.2
Sedentary work, asymptomatic	96.7%± 9.0	98.7%± 4.0	95.2%± 5.0
Sedentary work but breathless	60.2%±20.9	85.3%±15.8	87.3%±12.5
Unable to work because of breathlessness	43.4%±18.2	75.3%±11.6	81.5%±13.5
Retired, asymptomatic	93.5%± 9.6	93.9%±11.6	89.5%± 6.5
Retired but breathless	62.9%±23.0	78.4%±21.6	82.2%±14.4

* Values expressed as percentages of predicted normal value.

The same results are shown more graphically in the scatter diagram (fig. 1). This depicts the results for the maximum breathing capacity in each of the seven groups.

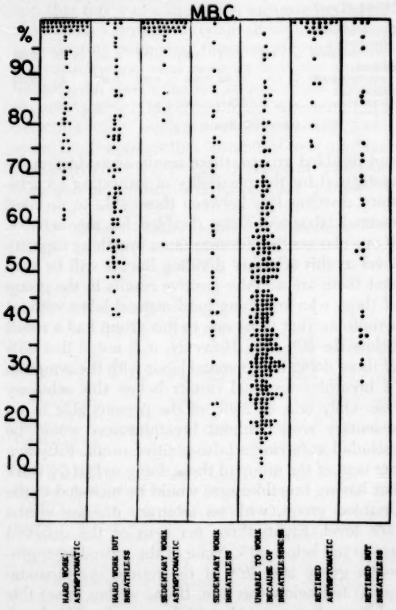

Fig. 1.—Maximum breathing capacity as percentage of predicted normal value.

The three asymptomatic groups, in general, revealed the highest percentage values for this test. The three symptomatic groups formed a distinct set, but with a somewhat wider scatter than the three asymptomatic groups. The disabled group of miners who, according to their history, were disabled for work because of shortness of breath had a much lower mean value for the maximum breathing capacity than any of the other groups, but again there is considerable scatter. The results of the vital capacity test are shown in graphic form in figure 2. The asymptomatic groups, in general, again showed the higher values. The three symptomatic groups had an intermediate value and the disabled group the lowest. However, in comparing the results of

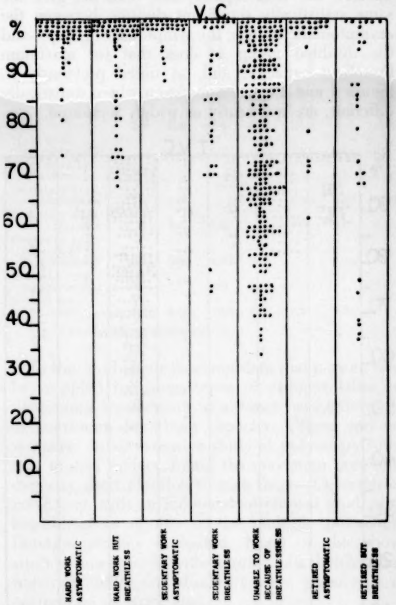

Fig. 2.—Vital capacity as percentage of predicted normal value.

this test with those of the maximum breathing capacity test, there is not nearly the same wide differentiation between the asymptomatic and the symptomatic on the one hand and the disabled group on the other; that is, the overlapping is much greater and the difference between the highest and the lowest values is not nearly as great. The results of the three-second timed vital capacity test are shown in figure 3. The same general trend is present here. The results can be divided according to the three broad groups, asymptomatic, symptomatic, and disabled; however, as in the case of the vital capacity test, the resolving power of this test in this respect is not nearly as great as that of the maximum breathing capacity test.

The statistical significance of the results is expressed in tables 4, 5, and 6. Table 4 lists the p values for differences between the various groups insofar as the maximum breathing capacity is concerned. A p value of 0.01 or less is considered as indicating significance. The divisions suggested by figure 1 are shown to be actually present and highly significant, from a statistical point of view.

Table 5 lists the p values for differences between the various groups with regard to vital capacity. In general, the vital capacity test does not give the same statistically significant division between the asymptomatic groups, the symptomatic groups, and the disabled group as does that for maximum breathing capacity; and, as noted previously in figures 1 and 2, the results, even where statistically different, are not nearly as widely separated.

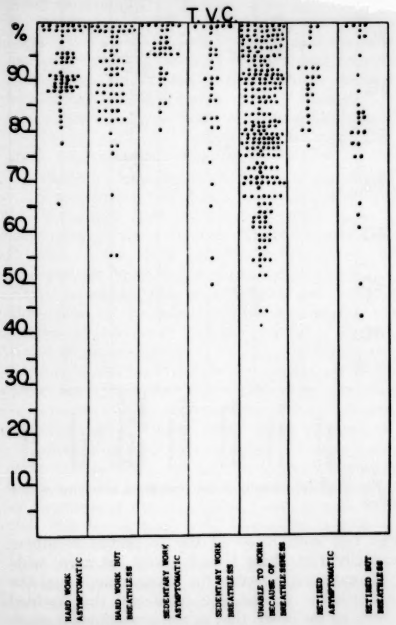

Fig. 3.—Three-second timed vital capacity as percentage of total vital capacity.

Table 6 lists the p values for the differences between the various groups with regard to the three-second timed vital capacity. When considering this parameter of pulmonary function, the disabled group was not different from the sedentary work, symptomatic, nor from the retired, symptomatic, group. Thus this test does not appear to differentiate as well between the various work groups as does that for vital capacity and certainly not nearly as well as the maximum breathing capacity test. Again, a glance back at figures 1 and 3 will illustrate the lack of resolving power of this test, in comparison with that for maximum breathing capacity.

Since, of all three tests studied, that for maximum breathing capacity seemed to give the best differentiation between the asymptomatic, symptomatic,

TABLE 4.—*Values for Differences Between Mean Maximum Breathing Capacities**

	Hard Work, Asymptomatic	Hard Work but Breathless	Sedentary Work, Asymptomatic	Sedentary Work but Breathless	Unable to Work Because of Breathlessness	Retired, Asymptomatic	Retired but Breathless
Hard work, asymptomatic ..	...	0.001	0.01	0.001	0.001	0.2	0.001
Hard work but breathless	0.001	...	0.001	0.05	0.001	0.001	0.3
Sedentary work, asymptomatic ..	0.01	0.001	...	0.001	0.001	0.3	0.001
Sedentary work but breathless ..	0.001	0.05	0.001	...	0.001	0.001	0.7
Unable to work because of breathlessness ..	0.001	0.001	0.001	0.001	...	0.001	0.001
Retired, asymptomatic ..	0.2	0.001	0.3	0.001	0.001	...	0.001
Retired but breathless	0.001	0.3	0.001	0.7	0.001	0.001	...

* $p \leq 0.01$ considered significant.

and disabled groups, these results were further investigated for the possibility of indicating an arbitrary dividing line between those able to do hard manual labor and those disabled for this activity. If one chooses the 60% maximum breathing capacity level as this arbitrary dividing line, it will be seen that there are no false-positive results in the group of those who are doing hard manual labor without symptoms; that is, no one in this group had a result below the 60% line. However, it is noted that 35% of those doing hard manual labor with the symptom of breathlessness had results below this arbitrary line. Only one, or 2.9%, of the persons able to do sedentary work without breathlessness would be included as having a false-positive result. Fifty-five per cent of the group of those doing sedentary work but having breathlessness would be included in the disabled group, with an arbitrary division at the 60% level. Eighty-three per cent of the disabled group fell below 60%. None of the retired asymptomatic group and 46% of the retired symptomatic group fell below this line. If one wishes to set this arbitrary line somewhat higher, at the 70% level, then 6.5% of the working, asymptomatic group would be included as having false-positive results. The other groups increase somewhat, with the exception of the sedentary work, asymptomatic and the retired, asymptomatic groups. Ninety per cent of the disabled group would now fall below our arbitrary line.

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V. 1

Comment

To our knowledge, this is the first study involving correlations between pulmonary function, patient's history of ability or disability for work, and symptoms. There are many studies dealing with evidence of dysfunction in subjects with pulmonary symptoms. Theodos and co-workers [2] demonstrated the poor correlation between clinical evaluation and physiological detection of disability. Motley and co-workers [3] reported on the correlation between various parameters of pulmonary function and varying degrees of emphysema in miners with anthracosilicosis. In this study the maximum breathing capacity test was observed to reveal the best correlation with varying degrees of emphysema when compared to any other single test. Gordon and co-workers [4] from the same laboratory also compared the ability of various pulmonary function tests to indicate emphysema. It was their belief that the degree of emphysema was best expressed by the residual air as a percentage of the total lung volume and that this was a significant measure in disability evaluation. They stated that as single measurements, in evaluating pulmonary function, maximum breathing capacity and vital capacity tests are somewhat limited; the determination of maximum breathing capacity was felt to be useful as a screening test for detecting early evidence of fibrosis with loss of elasticity. It appears that "disability" was used interchangeably with varying degrees of pulmonary emphysema in their study. In 1953 Motley [5] reported on more than 500 coal miners. Persons with a maximum breathing capacity between 55 and 80% of the predicted normal were considered to have a moderate degree of pulmonary function impairment, and those with below 55% were considered to have an advanced degree of pulmonary function impairment; however, the ability of the person to perform work was not given. This would appear to agree with our data indicating the 60% level as the level of significant pulmonary insufficiency for those doing the hard manual labor of coal mining.

TABLE 5.—*Values for Differences Between Mean Vital Capacities**

	Hard Work, Asymptomatic	Hard Work but Breathless	Sedentary Work, Asymptomatic	Sedentary Work but Breathless	Unable to Work Because of Breathlessness	Retired, Asymptomatic	Retired but Breathless
Hard work, asymptomatic ..	...	0.05	1.0	0.001	0.001	0.2	0.001
Hard work but breathless	0.05	...	0.02	0.02	0.001	1.0	0.01
Sedentary work, asymptomatic ..	1.0	0.02	...	0.001	0.001	0.2	0.001
Sedentary work but breathless ..	0.001	0.02	0.001	...	0.01	0.05	0.2
Unable to work because of breathlessness ..	0.001	0.001	0.001	0.001	...	0.001	0.5
Retired, asymptomatic ..	0.2	1.0	0.2	0.05	0.001	...	0.01
Retired but breathless	0.001	0.01	0.001	0.2	0.5	0.01	...

* $p \leq 0.01$ considered significant.

Higgins and co-workers [6] stated that it was their clinical impression that those persons with a maximum breathing capacity of less than 50 liters per minute are usually definitely crippled by their respiratory insufficiency. We would certainly agree with this but believe from our data that persons may be crippled for some types of arduous labor by ventilatory insufficiency at a somewhat higher level of maximum breathing capacity. Gilson and coworkers,[7] in an extensive study of pulmonary function in coal miners, found the maximum breathing capacity determination to give the best correlation coefficient with an independent clinical grading of breathlessness of any of the multiple pulmonary function studies evaluated. None of the above studies, however, provide a guide as a dividing line between ability and disability for a given type of occupation or work load.

TABLE 6.—*Values for Differences Between Mean Three-second Timed Vital Capacities**

	Hard Work, Asymptomatic	Hard Work but Breathless	Sedentary Work, Asymptomatic	Sedentary Work but Breathless	Unable to Work Because of Breathlessness	Retired, Asymptomatic	Retired but Breathless
Hard work, asymptomatic ..	...	0.2	0.02	0.05	0.001	0.1	0.01
Hard work but breathless	0.2	...	0.01	0.3	0.001	0.7	0.01
Sedentary work, asymptomatic ..	0.02	0.01	...	0.01	0.001	0.01	0.001
Sedentary work but breathless ..	0.05	0.3	0.01	...	0.02	0.4	0.2
Unable to work because of breathlessness ..	0.001	0.001	0.001	0.02	...	0.001	0.8
Retired, asymptomatic ..	0.1	0.7	0.01	0.4	0.001	...	0.05
Retired but breathless	0.01	0.01	0.001	0.2	0.8	0.05	...

* $p \leq 0.01$ considered significant.

It may be that the best type of pulmonary function tests for disability evaluation would permit one to know the oxygen requirement for the type of work for which the person was being evaluated. His ability to perform an equivalent work load without an increased oxygen cost or accumulation of an oxygen debt above the norm for that job would then be determined.[8] This ideal is still in the future, and we are faced with the hard fact of determining today whether or not a given patient who alleges that he is too dyspneic to carry on hard manual labor is actually disabled for his job. If we wish to employ the maximum breathing capacity test as the simplest aid to evaluation of disability from pulmonary disease at the present time, it appears from the data presented that the patient who claims he is too breathless to work, and is found to have a maximum breathing capacity of 60% or less of the predicted normal, is most likely disabled for the hard

manual labor of coal mining. If he has a maximum breathing capacity above 60% of normal and seems to be a stable person, arterial oxygen studies would be indicated to determine whether or not arterial anoxemia may be the cause of his symptoms. According to our experience this will leave approximately 13% of persons alleging inability to work because of breathlessness without an explanation for their symptoms on the basis of either inadequate oxygenation or ventilation. Some of these are unquestionably neurotic,[9] and some may have pulmonary disability not detectable by either of these techniques.

We do not believe the data reported herein can be broadly applied, except to coal miners and others whose work load is equivalent to that of the underground coal miner. As mentioned previously, a man may be completely and totally disabled for such work as the underground mining of coal and quite able to carry on in a job which is not attended by the same requirements of oxygen intake or ventilation. We wish to propose, on the basis of this study, that the vital capacity and three-second timed vital capacity tests are not nearly as well correlated with a history of breathlessness and the man's ability to perform his job as a coal miner as in the maximum breathing capacity test. Furthermore, the dividing line of a maximum breathing capacity of 60% of the predicted normal serves as the best guide to dividing those able from those unable to work because of shortness of breath. In those persons whose maximum breathing capacity is above 60% of the predicted normal value but who have pulmonary symptoms a certain number will be found to be disabled after studies of arterial oxygenation; however, this technique is necessary to detect only a relatively small number of men in the over-all group. We would most strongly protest the incorporation of these results into any compensation laws, social security acts, or similar fixed rigid plans of disability evaluation. We believe these results represent a guide and a starting point from which to work and that other and better methods of evaluating disability should be forthcoming; meanwhile, the maximum breathing capacity test appears to represent the best guide at this time.

Conclusions

In 482 persons, most of whom were soft-coal miners, the maximum breathing capacity test provided the most significant correlation with symptoms and history of ability to work without pulmonary symptoms, when compared with the vital capacity or three-second timed vital capacity tests. On the basis of the maximum breathing capacity determination the persons who are able to perform hard manual labor without symptoms of breathlessness, those who are able to perform sedentary work without breathlessness, and those who have retired from active work and are free of symptoms constitute one broad group of persons who are significantly different on the basis of the maximum breathing capacity from those in the same work category but having symptoms of breathlessness. Persons in both of the above broad groups have a mean maximum breathing capacity significantly greater than those in the group whose members are unable to work because of breathlessness. If a maximum breathing capacity level of 60% of the predicted normal is used as an aid to indicate disability, no false-positive results were included in the group of those able to do hard work without symptoms. Only one such person was included in the group of those able to do sedentary work without symptoms; however, 17% of those in the disabled group were missed as having false-negative results by this criterion alone. At the present time, of the three tests of pulmonary function which can most readily be performed in the usual general hospital or physician's office, the maximum breathing capacity test offers the most practical objective guide to evaluation of disability, with regard to hard manual labor in coal mining. Studies similar to this should be done to serve as a disability guide for other groups of workers.

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HYPERTENSION, PREGNANCY, AND PHEOCHROMOCYTOMA

Capt. George L. Calvy (MC), U. S. N., Lieut. Myron E. Resnick (MC), U. S. N. R., Lieut. Douglas R. Knab
and
Capt. Jesse F. Richardson, (MC), U. S. N.

Two secundiparas experienced episodes of hypertension both before and after delivery. Diagnostic tests in each instance led to the suspicion of pheochromocytoma, and removal of the tumor was followed by complete recovery. Five diagnostic tests that proved to be of particular value in these cases were (1) urinary assay of catechol amines, (2) the phentolamine adrenergic blocking test, (3) the histamine provocative test, (4) the piperoxan antidiuresis test, and (5) inferior vena cavography.

Severe hypertension in late pregnancy often connotes impending eclampsia. In some instances hypertension, either sustained or paroxysmal in character, may not conform with diagnostic criteria of eclampsia and may fail to respond to usual therapy. In such circumstances, pheochromocytoma merits serious consideration in the exercise of differential diagnosis.

It is the purpose of this report to describe two patients with unsuspected pheochromocytoma who presented with severe hypertension during pregnancy. Persistence of hypertension post partum directed attention to a search for the presence of pheochromocytoma in the first case, with subsequent diagnosis and definitive surgical removal. Indeed, this experience served to elevate general clinical awareness of this entity and was rewarded by discovery of a second case a few months later.

Report of Cases

CASE 1.—A 22-year-old woman, gravida 2, para 2, was transferred to the U. S. Naval Hospital, St. Albans, from the obstetric division of another service hospital. History of a normal pregnancy was noteworthy for a 31-lb. (14-kg.) weight gain. Results of repeat urinalyses were negative for albumin and her blood pressure was always noted to be within normal limits. Her expected date of confinement was Nov. 4, 1958. On Oct. 23 she was admitted to the hospital complaining of malaise, fatigability, nausea, vomiting, sweating, and headache. Her blood pressure was initially normal but began to rise; anesthesia was induced intravenously with oxytocin (Pitocin), and the patient was delivered of a normal living male infant. Postpartum blood pressures continued to be elevated, averaging 200/140 mm. Hg but showing marked hourly fluctuations, ranging from 100/70 to 300/150 mm. Hg. She was given amobarbital (Amytal), magnesium sulfate, meperidine (Demerol) hydrochloride, and phentolamine (Regitine) in an attempt to control her blood pressure. The phentolamine seemed the most efficacious, but marked fluctuations ruled out any conclusive observations. The patient was then transferred to St. Albans. In addition to the foregoing history it was learned that one year previously she had had a two-stage total thyroidectomy for a "nodular" goiter. Family history was negative for evidence of hypertension.

From the departments of medicine, obstetrics, and urology, U. S. Naval Hospital, St. Albans, N. Y. Capt. Calvy is now at the Naval Medical Field Research Laboratory, Camp Lejeune, N. C.

Physical examination revealed a thin woman in obvious distress, complaining of headache in the right temporal region. Temperature was 99.2 F (37.3 C), pulse 88, and respirations 22 per minute. Blood pressure was 190/130 mm. Hg. Eyegrounds were normal. There was a well-healed thyroidectomy scar with no palpable thyroid gland. Her lungs were clear and the heart was of normal size, with no murmurs audible. There was no hepatomegaly or other abdominal masses. No edema was present.

Laboratory studies disclosed a hemoglobin value of 12.9 Gm.% and a hematocrit value of 51%. White blood cell count was 8,900 per cubic millimeter, with 56% neutrophils, 39% lymphocytes, and 5% eosinophils. Sedimentation rate was 10 mm. in one hour (Wintrobe). Urinalyses showed a specific gravity of 1.015 and the presence of albumin. Between 30 and 40 white blood cells and 2 to 5 red blood cells per high-power field were found. Blood urea nitrogen level was 12 mg.% and fasting blood sugar (Somogyi-Nelson) level was 145 mg.%. Urine culture was sterile, and results of serologic (cardiolipin microflocculation) test for syphilis and Watson-Schwartz test for porphobilinogen were negative. Urine assay for catechol amines was strongly positive, suggesting pheochromocytoma. Basal metabolic rate was –11%. Radioactive iodine uptake was 39%, with a 27% conversion ratio.

A 24-hour 17-ketosteroid output on Nov. 19 was 0.87 mg. In view of this latter finding all medication was discontinued, and the patient was given a diet containing 2 Gm. of salt. Extensive electrolyte and 17-ketosteroid studies recorded a progressive return to normal levels.

Blood pressure levels fluctuated hourly, ranging from 250-270/130-150 to 110-120/80-90 mm. Hg. The levels were usually lower during sleep, and headache was associated with the hypertensive peaks. On Nov. 10 a histamine test induced a rise from 140/102 to 240/150 mm. Hg in 90 seconds, with a return to 140/80 mm. Hg in 10 minutes. On Nov. 13 a piperoxan antidiuresis test [1] caused a fall in blood pressure from 190/140 to 100/68 mm. Hg in two minutes (after intravenous administration of 20 mg. of piperoxan) and a marked antidiuresis after piperoxan; the ratio of the per minute urinary output before and after the drug was 1.7:1. On Nov. 14 a phentolamine test showed a drop in blood pressure from 260/190 to 124/90 mm. Hg in 60 seconds, to 98/64 in 150 seconds, and a return to 215/156 mm. Hg in seven minutes.

On Nov. 17 an inferior vena cavagram [1A] (phlebogram of the inferior vena cava with contrast medium injected into the right femoral vein) indicated the presence of a 6-cm. mass in the region of the right adrenal gland. On Nov. 19, at laparotomy through a transverse subcostal abdominal incision, a 6-cm. tumor mass in the right adrenal gland was removed. The pathology report identified this tumor as a benign pheochromocytoma. The left adrenal and aortic areas were also explored and were normal.

Postoperatively the patient's blood pressure level was maintained with levarterenol, which was discontinued after six to eight hours when pressure stabilized between 100 and 120/80 mm. Hg. The 17-ketosteroid level on Nov. 26 was 11.25 mg. per 24 hours. Results of a Thorn test on Dec. 2, 1958, with 40 units of ACTH given intravenously showed a 50% drop in eosinophils. Results of two histamine tests postoperatively were negative. The patient maintained a normotensive blood pressure and was discharged on Dec. 3, 1958, asymptomatic.

Case 2.—A 37-year-old woman, gravida 2, para 2, whose expected date of confinement was Jan. 7, 1959, was seen on July 7, 1958, for her first prenatal visit with a history of hypertension that had occurred only during her previous two pregnancies. Her first delivery was Oct. 20, 1954, and hypertension was noted after eight months of gestation. One-half hour after delivery under spinal anesthesia the patient had gone into shock not related to blood loss. Her second delivery was Aug. 5, 1956, and hypertension was noted after the third month of pregnancy. The patient gave a history of being normotensive when not pregnant. Her husband, a hospital corpsman, took frequent blood pressure determinations at home that substantiated this fact. She denied any family history of hypertension or renal disease.

On physical examination she was found to be a well-developed, thin woman with a blood pressure of 118/85 mm. Hg, pulse 80, and respirations 16 per minute. The only positive physical finding other than a uterus compatible with the third month of pregnancy was a palpably enlarged, tender right kidney. The patient's progress was followed in prenatal clinic and her first elevated blood pressure (138/92 mm. Hg) was noted on July 21, 1958, but from Sept. 23, 1958, until delivery her blood pressures ranged from 130 to 158/98 to 110 mm. Hg.

Results of renal function studies were considered to be within normal limits, except that an intravenous pyelogram revealed a questionable mass at the superior pole of the right kidney. On Dec. 27, 1958, the patient was admitted in early labor and spontaneously delivered an apparently normal living male infant at 0540 the next morning under pudendal nerve block anesthesia. One cubic centimeter of oxytocin was given after the third stage, and blood pressure remained stable at 130/80 mm. Hg throughout delivery. During labor pressures ranged from 134 to 180/100 to 90 mm. Hg. The patient had a minor upper respiratory infection post partum, but she continued to have similar variations in blood pressure. A phentolamine test was performed, followed by an immediate drop in blood pressure of 30 mm. Hg systolic and 15 mm. Hg diastolic. Because the test was computed with a base-line blood pressure of only 140/95 mm. Hg it was not considered conclusive. The patient was discharged on her fifth postpartum day, to return to the clinic in three weeks.

On Jan. 27, 1959, the patient was readmitted to the hospital for evaluation of her hypertension. Findings at her admission physical examination were again within normal limits, except for blood pressure of 180/108 mm. Hg and a palpable right renal mass which moved with respiration; blood pressure was found to rise to 220/110 mm. Hg after palpation. Laboratory studies revealed a negative result of an amobarbital sodium test, but after injection of 0.5 cc. of histamine with a base-line blood pressure of 140/90 the pressure immediately dropped to 90/40 and then rose to 260/90 mm. Hg. Hemoglobin value was 12.6 Gm.%, hematocrit value 39%, and white blood cell count 10,350 per cubic millimeter, with 44% neutrophils, 50% lymphocytes, 4% monocytes, and 2% eosinophils. Total serum protein was 7.6 Gm.% with albumin 4.9 Gm.% and globulin 2.7 Gm.% (an albumin to globulin ratio of 1.8:1). Result of urinalysis was normal, showing a specific gravity of 1.009. A Fishberg test revealed specific gravity of 1.010 on all specimens. A phenolsulfonphthalein test revealed 72.5% dye excretion in 60 minutes and 80% in 120 minutes. Urine culture was sterile. Serum electrolyte levels were as follows: sodium 142, potassium 4.8, and chlorides 98 mEq. per liter; carbon dioxide–combining power was 26 vol.%, with urea nitrogen level of 15 mg.% and fasting blood sugar level (Somogyi-Nelson) of 107 mg.%. Result of a urine test for 5-hydroxyindole-

acetic acid (5-HIAA) was negative. A 24-hour specimen of urine examined for 17-ketosteroids revealed 6.2 mg. (0.339 mg.%). Urinary catechol amine excretion was above normal limits, suggestive of pheochromocytoma. The electrocardiogram was considered to be normal.

Posteroanterior roentgenographic studies of the chest showed clear lungs, heart slightly prominent to the left with a cardiothoracic ratio of 12 over 25, and a slight elongation of the aorta. On an intravenous pyelogram the superior pole of the right kidney could not be definitely delineated, and there was a mass along the lateral aspect in the region of the right suprarenal gland. On an inferior vena cavagram the column of contrast medium was normal to the upper margin of L-1, at which level the vena cava seemed to be displaced laterally towards the right and anteriorly.

On Feb. 4, 1959, with the patient under general anesthesia, a pheochromocytoma of the right adrenal was removed through a transverse subcostal abdominal incision. Result of a histamine provocative test was negative prior to closing the wound. The patient was moved to the recovery room on therapy with levarterenol (Levophed) bitartrate. Administration of levarterenol was continued intermittently until 0850 on Feb. 5, 1959, from which time the patient maintained a stable blood pressure at 120/80 mm. Hg. Therapy was maintained with Wangensteen suction and intravenous administration of fluids until the third postoperative day. The patient had an uneventful postoperative course and was discharged on Feb. 14, 1959, asymptomatic, with a blood pressure of 110/70 mm. Hg.

Comment

Nearly 400 cases of pheochromocytoma have been reported in the literature to date. Of these 35 have been known to be associated with pregnancy, according to Dean's review [2] and additional case reports by Cannon [2A] and Stutz and others [3] respectively.

The two cases herein described are the 36th and 37th reported instances of pheochromocytoma associated with pregnancy. This tumor has an equal sexual distribution and manifests itself most commonly in persons between the ages of 20 and 40 years, the childbearing period in women. Cannon [2] reported that in cases of pregnancy associated with manifestations of pheochromocytoma only 10% were diagnosed ante partum or ante mortem.

Although the true incidence of pheochromocytoma is unknown, data exist to suggest that it is not infrequently overlooked. In performing sympathectomy for essential hypertension, in series totaling 2,700 cases, and in separate analyses, both Graham [4] and Smithwick and others [5] reported an incidence of pheochromocytoma of approximately 0.5% in their cases.

The serious hazards accompanying pregnancy complicated by unrecognized pheochromocytoma are evidenced by a maternal mortality of 44 to 50% and an infant mortality of 40%. This clinical combination apparently is not sufficiently recognized, and the presenting syndrome is usually attributed to preeclampsia, eclampsia, or toxemia of pregnancy.

There are many approaches to the diagnosis of pheochromocytoma; the direction is governed by the character of the clinical "tip-off." It is not necessary for each individual patient to be subjected to the entire gamut of diagnostic procedures. Diagnosis in the two cases described, however, was firmly established by five different methods that yielded positive results, including (1) urinary assay of catechol amines, (2) phentolamine adrenergic blocking test, (3) histamine provocative test, (4) piperoxan antidiuresis test, and (5) inferior vena cavography.

Cavography was utilized in locating the tumor mass, which was on the right side in each case. Indeed, the usefulness of this procedure is particularly apparent in cases where the tumor may be encroaching on the inferior vena cava. The foregoing two cases are the first known to have been demonstrated by this technique, which will be reported in more detail by co-workers.[6] The piperoxan antidiuresis test [1] is one of the newer diagnostic aids and has exceptional promise, as indicated by results in case 1.

The operative approach in both cases was through a subcostal upper abdominal transperitoneal incision. Exploration was carried out first in the aortic area, then the left adrenal area, and finally in the known tumor area of the right adrenal. Histamine provocative testing was performed during surgery, after removal of the tumor, to determine the presence of other pheochromocytomas.

Summary and Conclusions

Hypertension during pregnancy due to unsuspected and unrecognized pheochromocytoma may be attended with grave consequences; the known maternal mortality is 44 to 50% and the infant mortality 40%. Diagnosis may be established with certainty and cure effected by surgical removal of the tumor or tumors. Phlebography by use of the inferior vena cavagram and the piperoxan antidiuresis test are two useful new diagnostic methods that can be employed in detecting this condition.

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INTESTINAL LIPODYSTROPHY (WHIPPLE'S DISEASE)

DIAGNOSIS BY SMALL-INTESTINE BIOPSY TUBE

Murray Brodoff, M.D., William A. Hoffman, M.D., Vincent A. DeLuca Jr., M.D.
and
Howard M. Spiro, M.D., New Haven, Conn.

In a 45-year-old man with a long history of recurrent peripheral arthritis and a more recent history of gastrointestinal symptoms, a biopsy specimen obtained from the small intestine by means of the Shiner tube here described led to the diagnosis of intestinal lipodystrophy. The diagnosis was confirmed during an exploratory laparotomy, at which no other abnormalities were found. A characteristic finding under the microscope was the enlargement of the intestinal villi with distinctive, foamy-appearing mononuclear cells seen most commonly in the mucosa but also in the submucosal and subserosal layers. The patient recovered gradually on conservative treatment, including therapy with ACTH. The most recent episode of arthritis responded to increased ACTH dosage.

Intestinal lipodystrophy (Whipple's disease), a rare disease characterized by steatorrhea, abdominal pain, emaciation, pigmentation, arthritis, and polyserositis, was first described in 1907.[1] Since then 79 cases have been described, only 61 of which fulfill all of the pathological criteria. Recent reviews have described the clinical pathological picture and the numerous proposed etiologies.[2]

Early diagnosis is important in view of the reported good response to treatment with adrenal steroids and ACTH.[3] The first cases were diagnosed by autopsy or at the time of surgery; more recently peripheral lymph node biopsy has been suggested as a diagnostic aid. The purpose of this paper is to stress diagnosis by means of the Shiner small-intestine biopsy tube,[4] use of which for the first time allows histological proof of intestinal lipodystrophy without surgical intervention.

Report of a Case

A 45-year-old man was admitted to the Grace–New Haven Community Hospital on Jan. 7, 1958, because of flatulence and diarrhea. For about 10 years he had had intermittent episodes of arthritis with painfully swollen fingers, elbows, and knees. In September, 1955, he had first noted anorexia, flatulence, heartburn, and diarrhea with light-colored, floating, foul-smelling stools. He sustained a 30-lb. (14-kg.) weight loss but after several months improved on nonspecific treatment. In October, 1956, there was a recurrence of diarrhea, together with an episode of "pneumonia" and a re-

From the Department of Internal Medicine, Yale University School of Medicine.

exacerbation of his peripheral arthritis. He received therapy with prednisone with improvement of his articular and gastrointestinal symptoms.

He remained well, save for failure to regain weight, until September, 1957, when diarrhea and abdominal pain recurred. At this time he was admitted to another hospital. Gastrointestinal series showed an abnormal pattern of the small intestine. Results of barium enema, roentgenographic studies of the gallbladder, esophagoscopy, and sigmoidoscopy were unremarkable. The patients stools were negative for blood but contained Giardia lamblia

on several examinations. Results of a liver biopsy and an inguinal lymph node biopsy were normal. Since treatment with quinacrine (Atabrine) hydrochloride for his intestinal parasites resulted in no improvement, the patient was transferred to the New Haven Hospital for further evaluation. By the time of admission the patient was feeling well except for mild anorexia and failure to regain weight. His diarrhea had ceased spontaneously.

At the time of admission the patient was a thin, alert, middle-aged man who appeared well tanned for midwinter in Connecticut. There was increased pigmentation on his buccal mucosa. Pulse was 72 per minute, blood pressure 90/60 mm. Hg, weight 115 lb. (53 kg.). There was slight abdominal distention, but no organs or masses were palpable.

The hematocrit value was 36% with a normocytic, normochromic blood smear. White blood cell count was 13,400 per cubic millimeter, with a normal differential. Result of the Venereal Disease Research Laboratories test for syphilis was negative. Urinalysis was normal. Stool was brown and guaiac negative, but there was increased fat on direct examination with acetic acid and Sudan 3. Nonprotein nitrogen and electrolyte levels were normal, as follows: serum calcium, 9.1 mg.%; phosphorus, 3.8 mg.%; and alkaline phosphatase, 6.8 Bodansky units. Total protein level was 6.1 Gm.%, with a normal electrophoretic pattern. Results of liver function tests were normal, including a prothrombin time of 100%. Blood pepsin level was 665 units. There was free acid in the stomach before histamine testing. Oral glucose tolerance test revealed a fasting blood sugar level of 62 mg.%; one-half hour, 117 mg.%; one hour, 120 mg.%; and two hours, 122 mg.%. Result of intravenous glucose tolerance test was normal. Serum amylase determination was normal. A 96-hour stool collection for fat showed an average of 3 Gm. per day on an approximately 50-Gm. fat diet, which is normal. Serum iron level was 42.5 mcg.%. Bone marrow was normal. Xylose tolerance test showed excretion of only 2.4 Gm. of xylose in five hours; normally, more than 5 Gm. should appear in the urine. Result of intravenous ACTH test for adrenal function was entirely normal; a fasting hydrocortisone (cortisol) level was 13.9 mcg.% and rose to 36.4 mcg.% four hours after administration of ACTH (normal). A Schilling test with radioactive-labeled vitamin B_{12} revealed a normal excretion of 21% at the end of 24 hours. Gastric biopsy by means of a Woods tube showed normal findings. A small-intestine biopsy by means of the Shiner tube was diagnostic of intestinal lipodystrophy (fig. 1).

The patient was discharged on Jan. 16, 1958. In February, 1958, he began to receive prednisone (Meticorten), 30 mg. per day. Two weeks later he again developed diarrhea and was admitted to another hospital. For the next six weeks he received 20 to 40 units of ACTH per day, intravenously and intramuscularly, with some clinical improvement. Because of crampy abdominal pain in the right lower quadrant, tarry stools, and gross rectal bleeding, he was readmitted to the Grace–New Haven Hospital on March 23, 1958. At that time his abdomen was distended and tympanitic; there were signs of peritoneal irritation in the right lower quadrant. X-ray studies of the abdomen showed nonspecific ileus and free fluid consistent with peritonitis. Although it was believed that the findings were compatible with the diagnosis of intestinal lipodystrophy, an exploratory laparotomy was performed with the patient under local anesthesia. No perforation or other gross abnormality of the peritoneal cavity was found. Thereafter, the patient

Fig. 1.—Portion of small intestinal villus containing macrophages with material giving positive periodic acid–Schiff stain diagnostic of intestinal lipodystrophy (× 250).

slowly improved despite a right deep femoral thrombophlebitis and episodic hypokalemia. A second episode of abdominal pain, again accompanied by signs of peritoneal irritation, was treated conservatively with parenteral administration of fluids, antibiotics, and ACTH. The findings in the peritoneal cavity gradually cleared, and the patient continued to improve and was discharged on May 22, 1958. At home the patient continued to receive 10 units of ACTH intramuscularly per day, and regained 30 lbs. (13 kg.) over the next four months, without signs of abnormal fluid retention. Since that time he has been generally free of symptoms except for one episode of arthritis which responded to increased ACTH dosage.

The patient was readmitted on Sept. 18, 1958, to the New Haven Hospital for a follow-up examination. Physical examination at that time showed that he now weighed 135 lb. (61 kg.) and that he appeared to be in general good health. Hematocrit value was 40%, stools were guaiac negative, a barium enema showed unremarkable findings, and an upper gastrointestinal series showed almost completely normal pattern of the small intestine, although there was still some coarsening of the folds. A repeat small-intestine biopsy showed no change in the periodic acid–Schiff (PAS) staining material in the mucosa.

Comment

The clinical picture of intestinal lipodystrophy is so suggestive that the diagnosis may be readily made. This patient showed the usual clinical manifestations: He was a middle-aged man with intermittent arthritis resembling rheumatoid arthritis, diarrhea, polyserositis, abdominal pain, distention, anorexia, and weight loss. He was hypotensive and emaciated, and his buccal mucosa was pigmented. There was episodic polyserositis; he had had one attack of "pneumonia," an episode of peritonitis, and intermittent arthritis. Laboratory examinations performed in the diagnosis of this disorder are nonspecific. Typically, there is a hypochromic microcytic anemia, with stools that may be positive for occult blood, as well as the usual finding of a malabsorption syndrome. In our patient the measurement of fecal fat excretion was normal during an apparent spontaneous remission. Gastrointestinal x-rays are useful only in ruling out a specific malabsorption disease and in showing, as in this patient, a nonspecific deficiency pattern of the small intestine.

To be considered in the diagnosis are the various entities grouped together under the "malabsorption syndrome," such as idiopathic sprue, chronic pancreatitis, or the symptomatic "sprues" associated with tuberculosis or lymphoma. Polyserositis and diffuse systemic symptomatology bring a collagen disease to mind. The hypotension, emaciation, and pigmentation may suggest hypoadrenalism; in this patient blood hydrocortisone levels and response to ACTH were normal. The definitive diagnosis was made by tissue examination. Typically, at operation or autopsy, large, succulent abdominal lymph nodes may be seen, together with dilated lymphatic vessels. The small intestine is thickened, and a yellow seeding in the mucosa representing fat-laden villi is often present.

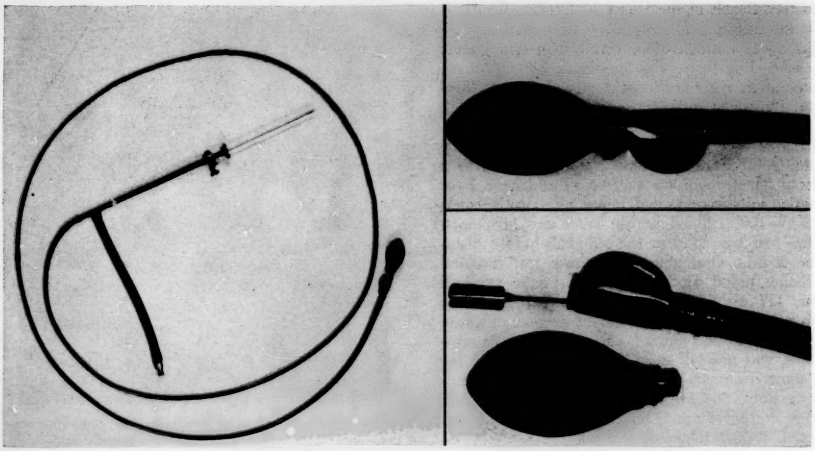

Fig. 2.—*Left*, Shiner tube. In center is handle which controls spring mechanism. Rubber side tube is for application of suction by means of syringe. Balloon end contains cutting blade. *Right*, close-up view of balloon head (top), ready for operation and (bottom) disassembled. Mucosa from small intestine enters aperture in "hand" portion when suction is applied proximally to tube. Cylindrical blade is then pulled by handle and piece of mucosa is obtained through guillotine action.

The microscopic picture is categorically diagnostic, as seen in figure 1. The intestinal villi are enlarged and the submucosa is thickened. The villi are filled with the characteristic "foamy" mononuclear cells which are most commonly seen in the mucosa but are also noted in the submucosal and subserosal areas. These foamy macrophages were

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first described by Whipple as not containing lipid-staining material. Black-Schaffer [5] first demonstrated that the material gave a positive PAS stain and suggested, therefore, that it was a glycoprotein. Lipid material, as demonstrated by lipid stains like Sudan 3, is prominent in the villi and the dilated lymphatics.[6] Perivascular fibrosis and hyalinization, frequently seen in the end-stage of the disease, may lead to intestinal scarring. At autopsy pleural, pericardial, endocardial, and peritoneal involvement are noted.

The characteristically positive PAS-staining cells are also noted in the mesenteric nodes and may be found in the peripheral nodes. Recently Dick [2b]

Fig. 3.—Flat film of abdomen showing Shiner tube passing through stomach and around to duodenal loop and proximal jejunum.

described two cases in which typical cell collections were found at autopsy in skin nodules. In our patient lymphadenopathy was not prominent, and the one lymph node on which biopsy had been performed was normal.

The Shiner tube (fig. 2) may be expected to be especially useful in the diagnosis of intestinal lipodystrophy, since the major disease process is found in the intestinal mucosa.[4] The Shiner tube is flexible, 128 cm. long, and 4.8 mm. in diameter. It is easily swallowed by the patient and guided by fluoroscopic control into the small intestine, usually into the third portion of the duodenum (fig. 3). Once the tube is in this position the procedure may be completed in several minutes. Suction is applied by a syringe so that a small knuckle of tissue is drawn into the 3.1-mm. aperture at the distal end of the tube. Through a spring mechanism attached to a cutting edge a small piece of mucosa is easily sucked into the lumen of the distal tube. Multiple biopsy specimens, up to seven in our experience, may be procured in this manner. The tube is then rapidly removed and the tissue immediately fixed in formalin. This method gives excellent preservation of mucosa as compared to the marked autolysis of intestinal mucosa usually seen in autopsy material. The procedure is innocuous, in our experience, and does not cause the patient much discomfort.

Summary

In the case of intestinal lipodystrophy (Whipple's disease) reported here the diagnosis was established by use of the Shiner small-intestine tube without abdominal exploration. No change in the positive periodic acid–Schiff (PAS) staining deposits in the mucosa was found after eight months of steroid therapy. The method is recommended as a means of diagnosis of this disease and other obscure small-intestinal syndromes.

333 Cedar St. (11) (Dr. Spiro).

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PNEUMOTHORAX AND EXTENSIVE EMPHYSEMA AFTER HIGH INTRATRACHEAL PRESSURE IN ANESTHETIZATION

Joachim S. Gravenstein, M.D., Gainesville, Fla.

During certain manipulations of a machine for inhalation anesthesia, a mixture of oxygen and nitrous oxide entered the patient's trachea suddenly and under sufficient pressure to escape into surrounding structures of the neck and chest. Pneumothorax on the left and mediastinal, muscular, subcutaneous, and retroperitoneal emphysema developed at once and were demonstrated in roentgenograms. The respiratory distress was relieved by mouth-to-endotracheal-tube ventilation, and the patient's pulse again became palpable; the ectopic gases were absorbed within a few hours, and the patient recovered without further complications. The arrangement of valves that made this accident possible has since been corrected by the manufacturer. Anesthesiologists must be alert to the possibility of such accidents with any form of anesthesia machines.

The increased use of endotracheal tubes in inhalation anesthesia exposes the patients to the consequences of increased pressure in the tracheobronchial tree sometimes to a greater extent than is true of a patient in whom intubation is not done. The effects of increased pressure during artificial or assisted ventilation have been widely discussed in the past. However, the possibility of exposing the patient to a sudden and forceful increase of pressure due to the construction of an anesthesia machine or the arrangement of the breathing circuit is less well recognized; therefore, the following case is reported.

Report of a Case

A 40-year-old woman entered the hospital because of a stricture of the sigmoid colon secondary to radiation treatment for carcinoma of the cervix. She gave no history and presented no findings indicative of pulmonary disease.

A sigmoid resection was planned. The patient was given premedication with atropine and pentobarbital. Anesthesia was induced with 250 mg. of thiopental; then 40 mg. of succinylcholine was given; and, after adequate oxygenation, a 36 F. endotracheal tube was easily inserted. A cuff was present on the tube but was not inflated. The endotracheal tube was connected to a Foregger machine with a CF-2 circle filter. The expiratory "Neff" valve was opened. Anesthesia was continued with administration of nitrous oxide and ether. Vital signs were stable and ventilation quiet and regular. At 8:10 a. m. cystoscopy was done. At approximately 8:14 a. m. soda-lime canisters were changed. At 8:15 a. m. the anesthetist noticed "ventilatory distress." Breathing appeared labored, and the breathing bag did not move freely. It was almost empty. Administration of ether and nitrous oxide, therefore, was discontinued, and an attempt was made to fill the bag with oxygen by use of the flush valve. However, while this valve was being used, it was noticed that the patient's neck had become distended. The patient's color turned pale; she became mildly cyanotic. Pressure on the breathing bag did not accomplish any gas exchange. There was obviously resistance in the system which could not be overcome by compressing the bag. Another attempt was made to fill the breathing bag by opening the oxygen flush valve, but the bag did not fill. The patient again showed swelling of her neck. The pulse became unobtainable. At this point, the anesthesia machine was disconnected; mouth-to-endotracheal-tube ventilation was performed, giving good exchange. With this treatment, pulse and blood pressure returned to normal readings. A pneumothorax on the left side was diagnosed; a tube was inserted into the left side of the chest, and gas gushed out under pressure. The tube was connected to water seal and suction, and a chest roentgenogram was obtained (see figure). The operation was canceled and the patient taken to the recovery room.

The patient had an uneventful recovery from this episode, and four days after the accident she was well enough to be discharged. Nine days after the complication, she reentered the hospital because of small intestine obstruction. She was operated on under inhalation anesthesia without intubation and had an uneventful operative and postoperative course.

Comment

The explanation for this dramatic and sudden complication was as follows: an anesthesia machine with the Foregger CF-2 circle filter had been used. This unit has two interchangeable absorbers with two valves: an upper selector valve and a lower shunt valve. The selector valve can be set to channel the gas into the left or right absorber canister.

Chief of Anesthesia, University of Florida Health Center.

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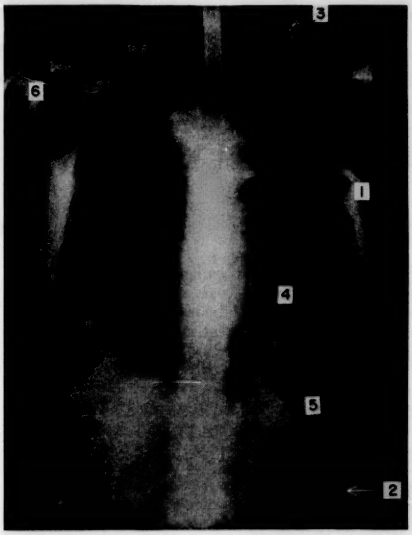
The lower shunt valve allows gas flow from one canister into the breathing bag while simultaneously blocking flow from the other canister into the bag. Thus, it is possible to set the selector valve to permit gas flow into the right canister and, at the same time, to close the shunt valve for flow from the right canister into the bag. In this case, no gas at all can flow from the breathing tubes through the absorber into the breathing bag. The gas then is forced directly into the corrugated breathing tubes and from there to the patient. The shunt valve handles are so arranged that it is quite easy to dislodge or mis-set them (the manufacturer has corrected the design of and offers replacement for these valves). In our case, even though the anesthetist was not aware of having failed to turn the lower shunt valve handle when she switched from one canister to the other, the gas flow past this valve must have been blocked to a great degree or completely. Of course, under these circumstances, a patient will show respiratory distress because the gas offered an adult patient with a flow of 2 or 3 liters of nitrous oxide and 1 liter of oxygen per minute is inadequate to allow inspiration. Also because the passage was blocked to the breathing bag, which represents an expandable reservoir, expiration was hindered and pressure in the circuit must have developed.

When the oxygen flush valve was opened, a tremendous gush of gas under high pressure found its way directly into the endotracheal tube. This must have led to rupture of lung tissue, trachea, or a bronchus with consequent left pneumothorax, mediastinal emphysema, muscular and subcutaneous emphysema, and retroperitoneal emphysema. The first x-ray, shown in the figure, was taken after the left-sided pneumothorax had been relieved, but gas could clearly be seen in the pectoral muscles outlining its structure in amazing detail in subcutaneous and mediastinal tissue. The air which found its way into the abdomen must have dissected a path along the aorta, which was provided with a fine air contrast, the splenic ligament outlining the spleen and along the mesentery of the descending colon, creating a contrast for this organ. The gas in subcutaneous tissue and mediastinum disappeared extremely rapidly. On a second roentgenogram, taken only a few hours after the first radiologic examination of the chest, significantly less gas was seen; four days after the accident only a small amount of subcutaneous emphysema was discernible. Probably no free gas in the mediastinum remained. Rapid absorption of free gas in the tissue spaces was to be expected, since it was pure oxygen which found its way into the patient's tissues.[1] All films showed a paratracheal mass which receded in size after the incident and was believed to be due to a hematoma in this area. This hematoma may have marked the site of the lesion produced by the high pressure.

Most anesthesia machines are equipped with "pop-off," expiratory valves which, in the "open" position, will allow almost unlimited gas escape as soon as a moderate pressure builds up in the breathing circuit. It is wise to keep these valves open at all times, unless assisted or controlled ventilation is used. The so-called Neff valve allows gas to escape only through a small hole. At high flow rates, the Neff exhaust valve is insufficient and high pressure can develop in a closed breathing system. In the case here presented, this did not contribute to the reported complication, since this valve and the breathing bag were shunted out of the circuit.

It is also prudent not to inflate cuffs on endotracheal tubes, unless dictated by necessity. The deflated cuff is not only kinder to the tracheal mucosa but, at the same time, it allows gas to escape around the tube. The fact that the cuff on the endotracheal tube was not inflated may have been lifesaving to this patient. Here it should also



Chest roentgenogram of patient one-half hour after accident, with endotracheal tube still in place and catheter in left pleural cavity. Both lungs are fully inflated: (*1*) gas in pectoralis major muscle, outlining course of the muscle across chest; (*2*) retroperitoneal gas in descending colon; (*3*) subcutaneous and subfascial gas in neck; (*4*) gas outlining descending aorta (demonstrating one path which oxygen may have found reaching retroperitoneal space); (*5*) margin of spleen outlined by gas which probably has dissected a way along splenic ligament; (*6*) gas in right axilla outlining ribs and intercostal spaces. Note paratracheal "mass," probably representing hematoma.

be emphasized that it is good practice to disconnect anesthesia machines and to rely on simple methods of resuscitation, such as mouth-to-endotracheal-tube or mouth-to-mouth ventilation, whenever, in emergencies, there is a question as to the performance of a machine or the composition of gases or anesthetic agents delivered by mechanical devices.

Conclusions

Due to faulty setting of valves, or due to accidental dislodging of valves on a modern anesthesia machine, a patient was nearly killed when exposed to high pressure which resulted in pneumothorax and extensive subcutaneous, mediastinal, muscular, and retroperitoneal emphysema. This accident, fortunately, is a rare complication, but it must be emphasized that such accidents can occur, even with brand new anesthesia machines manufactured by a reliable company enjoying and deserving an excellent reputation. All new machines, therefore, should be checked to make certain that a faulty setting of valves, with consequences as described above, is impossible. This type of accident is clearly preventable merely by rearranging valves on a piece of apparatus.

Drs. J. D. Reeves and E. H. Schultz Jr., Department of Radiology, University of Florida Health Center, provided interpretation of the chest roentgenograms.

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LEFT VENTRICULAR PUNCTURE IN THE ASSESSMENT OF AORTIC STENOSIS

John E. Connolly, M.D., San Francisco

The severity of aortic stenosis can be judged by measuring the pressure difference across the valve. Because the difference changes with flow, concomitant cardiac output determinations are desirable. The safest, easiest, and most reliable method of measuring this difference is by left heart catheterization with direct percutaneous puncture of the left ventricle. This puncture is combined with a direct brachial artery recording and is performed at the same time as right heart catheterization. Left ventricular puncture has been carried out in 50 consecutive patients without any complication. This procedure is a valuable tool both in the preoperative selection and in the postoperative evaluation of patients undergoing surgery for aortic stenosis.

Although right heart catheterization has been widely used for many years, its counterpart, left heart catheterization, is being practiced in comparatively few medical centers. The slower development of this latter technique is clearly due to the widely held view that it is a difficult and hazardous procedure. This is, in part, true, since serious complications have been reported with the best-known approach to the left side of the heart, namely, left atrial puncture by the posterior route.[1] Complications reported include hemoptysis, pneumothorax, shock, and even death.[2] For these reasons many cardiologists and cardiac surgeons have abandoned this procedure in favor of more recently developed and safer techniques. These include the transbronchial approach to the left side of the heart [3] and direct percutaneous puncture of the left ventricle.[4]

The transbronchial approach has been used in over 1,000 reported cases without serious complication.[3a] Its use has been primarily directed at assessment of the mitral valve in differentiating stenosis from insufficiency by the pressure pulse contour and, in turn, in the selection of patients for mitral commissurotomy. The lack of complications has clearly pointed up its superiority over the posterior percutaneous left auricular puncture in the evaluation of the mitral valve. Although its proponents have extended its use to the study of the aortic valve by catheterization of the bronchial needle, I feel that direct puncture of the left ventricle is decidedly superior in the assessment of the

From the Department of Surgery, Stanford University School of Medicine, and the Cardiopulmonary Laboratory of Stanford University Hospitals.

aortic valve. This technique was first shown to be feasible by Ponsdomenech and Beato Núñez in 1951 [5] when they used direct percutaneous puncture of the left ventricle to introduce contrast materials into the left ventricular cavity. Later, in 1956, Brock and associates [4a] reported the application of percutaneous left ventricular puncture to the assessment of the gradient across the aortic valve.

There are several disadvantages in using the bronchoscopic approach to the measurement of the aortic valve gradient. In the first place, bronchoscopy is more cumbersome to the operator and more uncomfortable to the patient. Second, bronchoscopic auricular puncture is not always successful in the presence of a normal-sized left auricle. Third, the catheter cannot always be passed into the left ventricle. Fourth, pressures transmitted through a small catheter are not free from damping.

In direct left ventricular puncture, tracings from the left ventricle are compared simultaneously with pressure tracings from a percutaneous brachial or femoral artery to obtain the pressure gradient across the aortic valve. When this is combined with simultaneous right heart catheterization, with application of the Fick method, one can obtain the cardiac output and in turn calculate the size of the valve orifice.[6] Greene and co-workers [4c] recommend direct left ventricular puncture combined with the suprasternal notch puncture of Radner.[7] In this technique an 18-gauge needle is passed via the suprasternal notch through the arch of the aorta and pulmonary artery and finally into the left atrium. A blind puncture of these vessels again carries the same potential complications as the percutaneous left auricular technique of Bjork. In aortic stenosis the radial systolic pressure, unlike the normal, is commonly a few millimeters of mercury less than the simultaneously recorded central systolic pressure.[8] Thus, the error introduced by brachial or femoral artery puncture is not significant and avoids the hazards of the suprasternal puncture of retrograde aortic catheterization. If a marked aortic gradient is seen in the presence of a relatively large estimated aortic valve area, significant aortic regurgitation may be suggested. A large gradient in the presence of a pulsus bisferiens also suggests aortic regurgitation.

Technique

The technique is that of Brock and co-workers,[4a] with several modifications. The puncture is carried out with the patient supine on the fluoroscopy table used for right heart catheterization. On occasion, left ventricular puncture has been performed with the patient in the sitting position when the supine position could not be tolerated. A standard Cournand needle is placed in the left brachial artery, or in the femoral artery in small children. If percutaneous puncture of the brachial artery is unsuccessful, the brachial artery is directly visualized by slightly extending the incision used for introduction of the right heart catheter. In this way the Cournand needle can always be introduced into the brachial artery.

If an apical impulse is present, which is usually the case in significant aortic stenosis, the location for the introduction of the needle is established. In this situation the apex of the left ventricle is almost subcutaneous. The skin wheal is made just slightly lateral and below this point, and a local anesthetic agent is infiltrated until the ventricular thrust is felt. Then a 10-cm., 19-or-20-gauge spinal needle is introduced through the wheal and directed in a line toward the right axilla. The inclination of the needle is about 30 degrees anterior to the body plane (fig. 1). With a large heart, in which the apical impulse is often in the axillary line, the needle is introduced straight in on a parallel plane with the sternum. The apical impulse should be

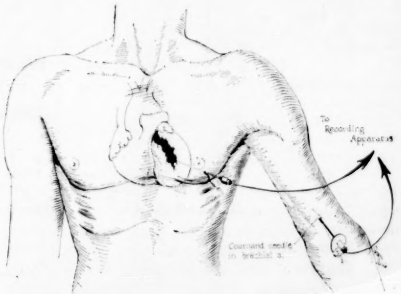

Fig. 1.—Diagram showing direction of left ventricular needle puncture and Cournand needle in brachial artery for simultaneous pressure recordings.

sought before premedication and marked, as it may disappear during the basal conditions of the catheterization. If an apical impulse is not present the operator can judge the position of the apex by studying the chest x-ray and then, at the time of puncture, utilizing the fluoroscope to guide the needle to the apex. The two initial failures in the present study occurred before fluoroscopy was adopted for difficult cases.

When the needle is in the correct position the thrust of the apex of the left ventricle is transmitted to the operator's hand. The needle is then advanced about 1½ in. and the stylet is removed. If the tip of the needle is in the left ventricular cavity a spurt of bright red blood is obtained. If blood does not return, the needle is moved a bit further in or out. Some of the earlier punctures at this laboratory were into the right ventricle and, as pointed out by

Greene and co-workers,[4c] the color of the blood coming from the needle immediately identifies the ventricle that has been tapped and regulates the procedure accordingly. I have found that a 19-gauge or 20-gauge spinal needle connected by 100 cm. of heavy vinyl tubing to a Statham P23Db strain gauge produces excellent pressure tracings in an adult. However, a 22-gauge needle should be used in children to avoid a relatively large puncture site and possible cardiac tamponade. The needle is left in the heart usually not over a minute or two at the most unless contrast medium is to be injected at the same time into the ventricular cavity for roentgenographic studies. The electrocardiogram is monitored throughout the procedure, and if an undue number of ectopic beats occur the procedure is discontinued momentarily until sinus rhythm is restored.

No complication has occurred in over 50 consecutive punctures, although I am aware of several cases of tamponade that have occurred at other clinics with a similar technique. The patient is watched carefully for the early signs of tamponade, but the use of smaller gauge needles should eliminate this danger.

In a number of cases of pure aortic stenosis a gradient across the aortic valve of less than 50 mm. Hg was found and these patients were thus considered to have insignificant amounts of aortic stenosis. One should remember, however, that in the presence of concomitant mitral stenosis the gradient across the aortic valve may be much less, due to the relative protection afforded the left ventricle by significant mitral stenosis. In such cases of double valvular stenosis a smaller gradient across the aortic valve may indicate significant aortic stenosis. For example, Wood [9] has indicated that a gradient of 25 mm. Hg across the aortic valve indicates appreciable stenosis in the presence of concomitant mitral stenosis. The application of this technique is best demonstrated in a case of severe aortic stenosis which was studied by left ventricular puncture before and after aortic and mitral valvulotomy.

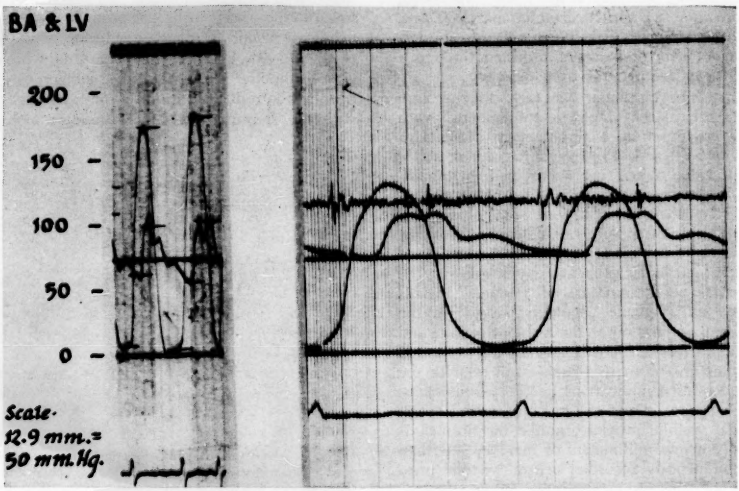

Fig. 2.—Simultaneous brachial artery and left ventricular tracings: *left*, before operation, showing mean systolic ejection gradient approaching 70 mm. Hg, and, *right*, after aortic valvulotomy, showing marked reduction in gradient across aortic valve.

Report of a Case

A 34-year-old man was admitted on March 7, 1957, with the chief complaint of shortness of breath of two years' duration. He gave a history of rheumatic fever at the age of 3 years and frequent episodes of hot swollen joints until the age of 19 years. For two years prior to admission he had had progressive, severe, exertional dyspnea and probably angina. He had also had frequent episodes of pulmonary edema.

Physical examination showed a blood pressure of 95/75 mm. Hg and irregular pulse. On examination of the heart the apical impulse was felt in the sixth interspace 2 cm. beyond the midclavicular line. There was a grade 3 systolic ejection murmur heard

over the aortic area and into the neck and a grade 2 diastolic murmur heard best along the left sternal border. There was a grade 2 systolic murmur at the apex transmitted to the left axilla. There was also a grade 2 diastolic rumble at the apex. The clinical diagnosis was aortic and mitral stenosis.

Catheterization of the right and left sides of the heart was carried out simultaneously to determine which valvular stenosis predominated and how severe each was as evidenced by the gradients. The technique described above was used. Preoperative catheterization results on Aug. 20, 1957, were as follows: right pulmonary artery 40/24 mm. Hg; pulmonary artery wedge 18 mm. Hg; cardiac output 2.8 liters per minute; left ventricle 163/7 mm. Hg, brachial artery 102/65 mm. Hg; aortic valve gradient 61 mm. Hg; and aortic valvular area (calculated) 0.35 sq. cm.

The physical findings and the moderate elevation of pulmonary artery pressure and wedge pressure suggested some mitral stenosis. A gradient of 61 mm. Hg across the aortic valve indicated significant aortic stenosis. Therefore, operative attack on both valves was recommended.

Operation was performed on Aug. 22, 1957. With the patient under hypothermia and inflow occlusion for two minutes, 45 seconds, the aortic valve was inspected under direct vision. The cusps were moderately calcified and the commissures fused with a central lumen estimated to be 3 mm. in diameter. The three fused commissures were divided with a scissors. After this division the operator's finger could be easily introduced through the valve orifice. The mitral valve was then explored, utilizing the blind right-sided approach to the left auricle. Moderate stenosis of this valve was encountered, and the valve was opened satisfactorily by the operator's finger.

The patient's postoperative course was complicated by a staphylococcic septicemia which responded to bacitracin. Postoperative catheterization results on Dec. 23, 1957, were as follows: right pulmonary artery 32/18 mm. Hg; cardiac output 4.1 liters per minute; left ventricle 126/5 mm. Hg; brachial artery 104/71 mm. Hg; aortic valve gradient 22 mm. Hg; and aortic valvular area (calculated) 1.2 sq. cm.

At the time of writing, 18 months after operation, the patient's exercise tolerance is markedly increased. He can walk six blocks without stopping, as compared to 100 yd. before valvulotomy. He has returned to driving a tractor on his farm. Figure 2 shows the tracing of simultaneous left ventricular and brachial artery pressures before and after valvulotomy.

Comment

The procedure as practiced in this laboratory requires but a few minutes and can be performed during the course of an ordinary right heart catheterization study. It does not require moving the patient. Twelve of the first 14 punctures attempted resulted in successful entry into the left ventricle, and, since the technique has been perfected, all of the last 50 have been successful. The value of this technique in selecting patients for aortic valve surgery and also in evaluating their operative results has been demonstrated.

Summary

Catheterization of the left heart has become a well-recognized diagnostic tool in evaluating mitral and aortic valvular disease. This can be performed by left atrial puncture via the posterior route, by transbronchial puncture of the left atrium, or by direct percutaneous puncture of the left ventricle. When left heart catheterization is employed to evaluate aortic stenosis, the direct anterior percutaneous technique described is safer, easier, and more reliable than the other techniques available.

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CLINICAL NOTES

HYPERPARATHYROIDISM RECURRING TEN YEARS AFTER REMOVAL OF PARATHYROID ADENOMA

Joseph C. Greenfield Jr., M.D., John V. Verner Jr., M.D.
and
Frank L. Engel, M.D., Durham, N. C.

The purpose of this paper is to report on a patient who had two episodes of primary hyperparathyroidism separated by a 10-year asymptomatic period.

Report of a Case

A 35-year-old man was first admitted to the Duke University Medical Center on Sept. 19, 1945, for evaluation of pain in the back, ankles, and shoulders of two years' duration. He had also noted an enlarging, painful mass on the right clavicle for about one year. In the three years preceding this admission, he had experienced generalized weakness, anorexia, nausea, vomiting, epigastric pain, constipation, polyuria, polydipsia, photophobia, and a 10-lb. (4.5-kg.) weight loss. There was no history of renal colic.

On physical examination the blood pressure was 140/95 mm. Hg, with otherwise normal vital signs. The only abnormal physical finding was a nontender, 5-by-3-cm. bony mass in the right clavicle.

The admission laboratory data included a hemoglobin level of 13 Gm.%, and white blood cell count of 9,800 per cubic millimeter, with a normal differential count. Urinalysis showed the specific gravity to be 1.010, with a trace of protein, a strongly positive Sulkowitch reaction, and a clear sediment. The levels of various blood constituents on initial determinations were as follows: calcium, 15.2 mg.%; phosphorus, 2.0 mg.%; alkaline phosphatase, 15.1 Bodansky units per 100 ml.; nonprotein nitrogen, 40 mg.%; and total proteins, 7.9 Gm.%, with a normal albumin-globulin ratio (see table). Two-hour urinary excretion of phenolsulfonphthalein was 18% of the standard test dose.

Roentgenograms of the vertebrae showed generalized demineralization of the spine without collapse. A large trabeculated cyst was demonstrated in the right clavicle, and similar areas were present in the right scapula, several ribs, and the left tibia (fig. 1A). Fine calcific stippling was seen in the region of both kidneys on abdominal roentgenograms, suggesting nephrocalcinosis. Dental films revealed extensive resorption of the lamina dura.

On Sept. 29, 1945, surgical exploration of the neck was performed. An encapsulated mass 2 cm. in diameter was removed from the lower pole of the thyroid on the right. No parathyroid tissue was located at the superior aspect of the thyroid on the right. The superior and inferior parathyroid glands on the left were identified and were thought to be normal.

A single episode of tetany occurred shortly after operation and responded promptly to intravenous administration of calcium gluconate. The level of serum calcium fell to 8.0 mg.%, accompanied by a rise in serum phosphorus concentration to 3.7 mg.% at time of discharge. Polyuria, nausea, vomiting, and bone pain disappeared entirely.

The patient returned for an outpatient visit on Aug. 23, 1947, at which time he was asymptomatic. Roentgenograms showed healing of the skeletal lesions (fig. 1B).

Preoperative and Postoperative Blood Chemistry Findings During Two Attacks of Hyperparathyroidism

Blood Constituent*	Preoperative			Postoperative		
1st Attack	9/20/45	9/27/45	9/28/45	10/1/45	10/5/45	10/16/45
Calcium	15.2	17.7	12.5	9.7	9.0	8.0
Phosphorus	2.0	3.8	2.7	2.6	1.8	3.6
Alkaline phosphatase	...	15.1	...	...	16.2	...
Nonprotein nitrogen	...	40.0	...	...	55.0	40.0
2nd Attack	9/17/57	9/18/57	9/20/57	9/26/57	9/27/57	10/1/57
Calcium	12.8	13.9	15.8	11.0	9.6	9.0
Phosphorus	3.0	2.9	2.3	3.8	4.0	3.2
Alkaline phosphatase	...	2.1	2.6	...	...	...
Nonprotein nitrogen	46.0	...	...	62.0	...	52.0

* Units of measurement mg. % except for alkaline phosphatase, which is measured in Bodansky units per 100 ml.

The patient remained asymptomatic until the latter part of 1956, when he again noted the insidious onset of weakness, fatigue, nausea, vomiting, and constipation. He had also noted intermittent attacks of preprandial epigastric pain. There was no recurrence of bone pain and no renal colic. He was readmitted to Duke University Medical Center on Sept. 16, 1957.

The physical examination again was unremarkable. The blood pressure was 140/80 mm. Hg; the hemoglobin level, 14.2 Gm.%; and the white blood cell count, 6,400 per cubic millimeter, with normal differential count. The specific gravity of the urine was 1.011, and the sediment was normal. There was proteinuria (1+) and a strongly positive Sulkowitch

From the Department of Medicine, Division of Endocrinology, Duke University Medical Center.

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test. Levels of blood constituents were as follows: nonprotein nitrogen, 46 mg.%; total serum protein, 6.8 Gm.%, with normal albumin-globulin ratio; fasting blood sugar, 78 mg.%; alkaline phosphatase, 2.1 Bodansky units per 100 ml.; serum calcium, 13.9 mg.%; and serum phosphorus, 2.9 mg.% (see table). Two-hour urinary excretion of phenolsulfonphthalein was 20% of the test dose. There was good concentration of contrast medium in both kidneys after intravenous urography. Although roentgenograms again showed calcific stippling throughout both kidneys, the skeletal structures appeared normally calcified. Extensive resorption of the lamina dura of the teeth was again present. A roentgenogram of the upper gastrointestinal tract showed deformity of the duodenal bulb suggestive of scarring from peptic ulcer. An electrocardiogram, obtained when the serum calcium level was 16 mg.% and the serum potassium concentration 4 mEq. per liter, revealed a heart rate of 60 beats per minute, a Q-T interval of 0.36 second, and Qa-T interval of 0.28 second. The S-T segment duration could not be accurately determined. The electrocardiogram was otherwise normal.

Surgical exploration of the neck was performed on Sept. 24, 1957. A nodule 1.5 cm. in diameter and weighing 2.5 Gm. was removed from the right superior parathyroid area. Again the superior and inferior parathyroid glands on the left were normal to inspection. Postoperatively the patient had no evidence of tetany and became asymptomatic. The serum calcium and phosphorus levels returned to normal.

Pathological Findings.—The parathyroid adenoma removed in 1945 was 2 cm. in diameter and weighed 3.3 Gm. It was composed of sheets of well-differentiated chief cells with a minimal fibrous stroma. The adenoma was enclosed in a heavy capsule of dense fibrous tissue (fig. 2).

The second parathyroid adenoma, which was removed in 1957, was 1.5 cm. in diameter and weighed 2.5 Gm. Microscopic sections again showed the adenoma to be composed of well-differentiated chief cells occurring in solid sheets. Occasional areas in the tumor showed the formation of an acinar pattern (fig. 3).

Comment

The case reported represents the second one we are aware of in which clinical and pathological evidence of recurrent hyperparathyroidism appeared years after the removal of a functioning parathyroid adenoma. Shallow and Fry [1] reported on a patient who had two episodes of hyperparathyroidism separated by a 15-year asymptomatic period. Hagtvet and Matheson [2] described a patient who underwent surgical removal of two parathyroid adenomas and at autopsy four years later was found to have a third adenoma. Evaluation of the latter case was clouded, however, by the fact that severe renal disease was present, making it impossible to differentiate between primary and secondary hyperparathyroidism. The usual findings in secondary hyperparathyroidism include normocalcemia or hypocalcemia, hyperphosphatemia, symmetrical hyperplasia of all parathyroids, elevated alkaline phosphatase level, and osteitis fibrosa cystica generalisata.[3] During the second episode of hyperparathyroidism our patient had the opposite findings—persistent hypercalcemia, hypophosphatemia, normal alkaline phosphatase levels, and minimal bone changes. Also, at operation, one parathyroid adenoma was removed and two glands of normal size were left. These observations support the diagnosis of recurrent primary hyperparathyroidism.

In from 6% [4] to 8% [5] of all cases of hyperparathyroidism, multiple parathyroid adenomas are demonstrated at operation. Patients with persistent

Fig. 1.—Roentgenograms of right shoulder showing (*A*) bone cysts in scapula and clavicle and (*B*) healing after removal of parathyroid adenoma.

hyperparathyroidism caused by failure to remove all adenomas have been observed.[6] In the present case the right superior parathyroid gland was not identified during the initial operation and the

Fig. 2.—Photomicrograph of adenoma removed in 1945, demonstrating typical chief-cell adenoma. Fibrous capsule can be seen at left (× 297).

second adenoma developed in this area. It is possible that a small adenoma was present and was overlooked at the first operation. However, the development of tetany postoperatively, the return of serum calcium and phosphorus values to normal, the subsequent healing of bone cysts, and the long asymptomatic period hardly seem compatible with the presence of two functioning adenomas.

The finding of a deformed duodenal bulb by roentgenogram and the history of epigastric pain suggest that the patient had a peptic ulcer associated with parathyroid dysfunction. Peptic ulcer occurs frequently as a complication of hyperparathyroidism.[7] In a series reported by Black,[6] peptic ulcer was demonstrated in 24% of the patients with hyperparathyroidism and another 15% had symptoms suggesting peptic ulcer, although a duodenal lesion could not be identified.

Healing of bone cysts, as occurred in the patient reported on after removal of the first adenoma (fig. 1), is generally observed after surgical correction of hyperparathyroidism [8]; but it is of interest to note the occasional failure to recalcify bone.[9] The absence of roentgenographic evidence of bone involvement and the normal alkaline phosphatase level in our patient during the second bout of hyperparathyroidism are interesting. These findings correspond with the observation that, although bone disease was formerly the most common presenting complaint, the bones are less frequently involved at present than the kidneys.[10] The decreased incidence of bone manifestations and increased occurrence of renal involvement have been attributed either to an increased calcium intake in the diet [8a] or to the recognition of a milder form of the disease.[10b]

The prognosis is said to be much poorer once nephrocalcinosis and renal insufficiency occur, and death from renal failure can occur despite cure of the hyperparathyroidism.[11] Although our patient had definite renal disease in 1945, he enjoyed 10 years of good health between attacks of hyperparathyroidism and is again symptom-free without evidence of progressive renal insufficiency 11½ years after the first discovery of nephrocalcinosis and impaired phenolsulfonphthalein excretion. The presence of moderate renal insufficiency appears to be no contraindication to surgery, and renal function can sometimes improve after return of normal parathyroid function.

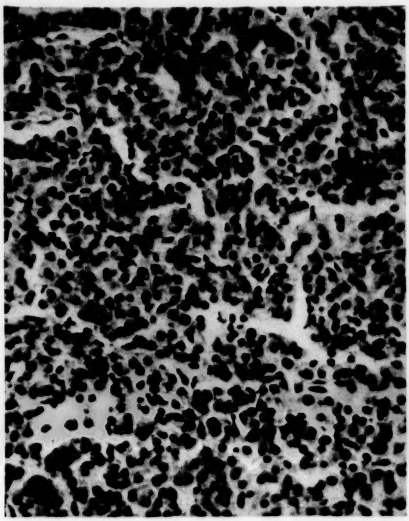

Fig. 3.—Photomicrograph of adenoma removed in 1957, demonstrating histological pattern of chief-cell adenoma (× 331).

Summary

A patient had two episodes of primary hyperparathyroidism separated by a 10-year symptom-free period. On each of these occasions a para-

thyroid adenoma was removed. Interesting features included healing of large bone cysts, the absence of demonstrable bone disease in the second attack, and the failure of renal disease to progress over a period of 11½ years.

Box 3428 (Dr. Greenfield).

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SPECIAL ARTICLE

THE YOUNG AESCULAPIAN

Tinsley R. Harrison, M.D., Birmingham, Ala.

Americans are usually considered to be doers rather than thinkers. This is not surprising in view of our relatively recent emancipation from the frontier, where sheer survival often depended not on thought but on action. However, during the past century we have begun to experience, as did Athens, Western Europe, and Britain before us, the impact of economic growth and of a rising living standard on our cultural mores. Thus, in medicine we now have not only persons who make fundamental scientific discoveries but also scholars and philosophers. To mention a few of the possible many we may cite the senior Holmes, Osler, Weir Mitchell, James B. Herrick, and Alan Gregg. It is to this expanding cultural tradition that Dr. Major belongs. A lecture in his honor might properly deal with some aspect of medical history, a subject to which he has made important contributions. There is little I could say in this field which is not familiar to Dr. Major, his associates, and pupils. But Dr. Major's interests have transcended medical history. He has had an abiding concern with clinical medicine and with those who will practice it—medical students and house officers. His book on physical diagnosis furnishes ample proof of his interest in the young Aesculapian, who is the subject of my discussion.

The theme will deal with some of the problems our young man either faces today or will face in the future. These are of two general types: those which affect him directly and immediately and those which concern society primarily but will determine the culture medium in which our young Aesculapian will grow or shrink, as the case may be. Before considering these problems as such, we may wish to look at some aspects of the broad background of our profession.

From the Department of Medicine, Medical College of Alabama.
The Ralph H. Major Lecture, read at the University of Kansas School of Medicine, June 13, 1959.

Medicine is concerned with knowledge of health and disease; not only with the application of such knowledge (prevention and care) but also with its acquisition (research), its dissemination (teaching), and its synthesis (ethics). To look at one facet only is to forsake our heritage from Hippocrates. He not only practiced the best medicine of his day but contributed new knowledge through his lucid descriptions of disease, and was perhaps the greatest medical teacher of all time: "I will teach them this art if they shall wish to learn it." His supreme contribution was his formulation of those principles which express the obligation of the physician to his patient. Attempts to solve the current problem in one of these broad areas without due attention to the others have been and, in my opinion, are likely to be either fruitless or, at best, only partially successful.

Facets of Medical Care

Preventive and curative medical care have three interrelated aspects: quality, cost, and availability. The availability of care has two facets, the number and the distribution of medical personnel and of healing facilities. In general, the public has medical care of steadily improving quality, readily available, at a reasonable cost. However, there are exceptions. Some care is of poor quality and not all of this is provided by charlatans or quacks. A few people are not able to pay for any medical care, and for many persons some illnesses involve an expense so overwhelming that neither direct nor insurance payment can provide an adequate solution. In many localities physicians are so overburdened that patients cannot receive the amount of time they desire or deserve, while in certain rural areas the number of doctors is so small that some patients receive almost no service at all. It is because of these several deficiencies, which involve a minority of those who are ill, that large and influential groups of laymen are advocating drastic changes in our whole medical milieu.

It would seem that our problem as a profession is to keep those large segments of our present system which are effective and to face realistically the unsolved problems involved in the remaining smaller segments. In this endeavor we should eschew alike the roles of a Candide, who regards our situation as the best of all possible medical worlds, and of a Cassandra, who foresees only an evil outcome from anything we now have or shall do. Rather we should lean on our scientific training and encourage pilot experimentation in order that ideas may be subjected to testing. It is unlikely that the solution to difficult problems will spring full-blown from the brow of any Jove, whether he be physician or layman. But, given enough time, the experimental method should provide the answers to these problems. The time may be short. It may be later than we think. Our European and Latin American friends have already adopted medical plans which most of us deem undesirable for our people. The effective method of avoiding this in the United States may be that of instituting experiments to seek answers based not on preconception but on observation. We shall not solve pressing problems by denying their existence.

Suggestions for Experiments in Medical Education

My purpose is to offer suggestions concerning certain experiments which would seem worth doing. Regardless of their outcome, we shall have learned something. Most of these experiments involve medical students and recent graduates, who hold the keys to the medical future. We may therefore consider some of their problems.

Concerning the number of physicians needed in the United States there is a wide difference of opinion. For several decades the ratio to population has remained essentially constant at a little more than 130 per 100,000. Some believe that the only expansion needed should be parallel to the increase in population because medical service of today is more efficient, with better communication (telephone), better transportation (roads), patients coming to physicians instead of the reverse, new diagnostic methods, and more technical personnel.

The chief reasons why I believe that there should be a much greater increase in the number of doctors are as follows: 1. Many physicians are no longer available to the general public as practitioners. This group includes physicians on military duty, pathologists, radiologists, teachers, investigators, interns, residents, etc. 2. There are more older physicians. Physicians will inevitably be affected by the mores of our society, which are tending toward a shorter work week and an earlier retirement age. 3. Modern scientific advances require a progressively larger number of medical man-hours in order to bring the public their benefits. One need think only of cardiac catheterization, the artificial kidney, and the newer operations on the cardiovascular system. 4. The rising economic and educational level is creating an additional desire on the part of the public for more medical service, preventive as well as curative. 5. Each step in medical progress means more older persons who have more illness and require more attention. Although arguments may be advanced for the opposite point of view these facts lead me to the conclusion that we need a large increase in our physician/population ratio.

This brings us to the problems of recruitment. Although the total number of applicants still exceeds the available places in medical schools, the discrepancy is lessening, and many believe that the number of well-qualified candidates is already deficient. Alan Gregg said: "In lengthening the preparation for the practice of medicine by two years of obligatory military medical service we may price ourselves out of the market of well qualified young men." During the past several years I have asked

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many students and recent graduates their opinions about the deterrents to a medical career. Most mention such factors as the competition from physics, engineering, and other sciences, but practically all are agreed that the two main factors are time and expense. Neither of these problems is insoluble.

There is doubt that we can compete with those nations on the other side of the Iron Curtain if we continue to educate our college and graduate students on a three-fourth time basis. Premedical students might have two summers, starting immediately after completion of secondary school, and one academic year devoted largely to cultural subjects. They could then be tentatively admitted to medical college for a full calendar year of natural science given at the medical school tempo. Those who achieved a mediocre but minimally acceptable record might be denied final admission to medicine

Such a plan would tend to overcome the barrier of time but might aggravate the economic deterrent to medicine, because there would be no chance for gainful employment during long vacations. This could be met either by a loan contract coupled with certain changes in the tax laws or, in the absence of such changes, by a scholarship with repayment pledge. Thus during his undergraduate and house-officer period a student who desired to participate might be advanced several thousand dollars. Repayment would depend not only on the amount received but also on the future annual net professional earnings. So long as such income was below a specified minimum, no obligation would exist. The person who became a medical missionary or chose an underpaid research career would owe nothing. The person who acquired a highly remunerative practice would be pledged to repay the school a relatively large sum annually,

TABLE 1.—*Proposed Plan for Financing Medical Students and Medical Schools**

			1st Yr.		After 10 Yr.		After 20 Yr.		After 30 Yr.		After 40 Yr.	
	Income of Graduates, Thousands	% Pledged to Medical School	Probable No. in Group	Income from Pledges, Thousands	Probable No. in Group	Income from Pledges, Thousands	Probable No. in Group	Income from Pledges, Thousands	Probable No. in Group	Income from Pledges, Thousands	Probable No. in Group	Income from Pledges, Thousands
Net income of graduates from professional work (before taxes)	Less than 10	0	All	0	300†	0	500†	0	500†	0	1,000†	0
	10	1.0	0	0	300	30	300	30	300	30	500	50
	15	1.5	0	0	200	45	500	112.5	700	157.5	500	112.5
	20	2.0	0	0	100	40	400	160	700	280	800	320
	30	3.0	0	0	80	72	300	180	500	450	700	630
	40	4.0	0	0	20	32	90	144	200	320	400	640
	50	5.0	0	0	0	0	10	25	100	250	100	250
Total income from pledges, thousands	...	...	...	0	...	209	...	651.5	...	1,477.5	...	2,002.5
Annual cost of grant fund, thousands‡	...	...	1,000		1,000		1,000		1,000		1,000	
Annual loss or gain, thousands	...	...	1,000 loss		791 loss		348.5 loss		477.5 gain		1,002.5 gain	

* Classes are assumed to be 100 each. Maximal grant per year $2,000. Maximal total grant per person $10,000. Various assumptions entirely arbitrary to illustrate general principles involved. Sums advanced and required repayment pledges might be less or more, if desired.

† Death, total disability, and scholastic failure would cancel grants. Voluntary withdrawal from medical school would involve indebtedness for sums received, plus interest.

‡ Assuming that each student accepts the maximum yearly for 5 yr.

but given a passing grade and returned to their academic colleges. Those meeting higher standards might enter medical school after the two full calendar years plus one summer of training. The medical course could then proceed continuously (with brief vacation periods) for four full calendar years, the last consisting of an internship, with the educational experience supervised by the medical faculty. Throughout the entire course certain cultural subjects should be required. By this means the present nine-calendar-year requirement for premedical, medical, and intern training might be shortened to about six years, with little or no loss of quality. This proposal is somewhat similar to the new plan at the Johns Hopkins Medical School. It involves a program which in some respects is intermediate between the present British and the American methods. It might or might not prove desirable, but we shall never know unless some schools are willing to try it.

while the modestly successful physician would pay yearly a much smaller percentage of his net income from his practice (table 1).

The details of such a plan might well vary from one school to another, but the general principle would seem to justify an experiment. About 90% of the students and house officers with whom I have discussed this plan have said that they would desire to participate in it. A school would need large additional funds during the first few years in order to initiate the program, but eventually might earn handsome profits from the continuing annual payments by its alumni. Such profits would appropriately come from those who had achieved the greatest financial success from their medical education. Tax deductibility of repayments would remove much of the objection to them.

Various other and perhaps better methods of overcoming the time and financial barriers to a medical career can be devised. We shall not know

the best procedures until a number have been tried. Assuming that some such plans will enable us to attract a sufficient number of well-qualified applicants, the perennial problem of the curriculum will remain. A few schools have had the courage to initiate changes, but in most of them the curriculum has remained relatively fixed during the half-century since the Flexner report. Neither the almost miraculous advances in the basic medical subjects, nor the emergence of the full-time system, nor the evolution of the clinical disciplines—or, at least, some of them—from empirical, rule-of-thumb darkness into intellectually respectable sciences has caused much change. Despite two world wars, revolutionary upheavals in government for most of mankind and the advent of the atomic age, this Gibraltar has held firm. Like Lot's wife, our curriculum prefers to look backward. One may only add that while it deserves her fate, it is more likely to become a pillar of ridicule for future generations. Our curriculum must be a Jezebel, to have so many admirers at such an advanced age.

Aims of Curriculum

Certain suggestions for curricular changes aimed at reduced time without loss of educational quality have already been mentioned. We may next consider the aims of the curriculum.

Nearly all would agree that a strong feeling of responsibility for his patient is the first mark of a good physician. Such motivation can only come from contact with patients. Yet, despite his deep yearning for it, the student is largely denied this until his third year in medical school, and in many places is allowed no real responsibility until he becomes an intern.

I would be the last to advocate any decrease in emphasis on basic principles of science. About 60 years ago Osler said: "To cover the vast field of medicine in four years is an impossible task." When we consider the subsequent growth of knowledge, the task becomes ridiculous. All we can hope to teach students are certain basic attitudes toward learning and toward patients, some basic principles, a few techniques which every doctor does or should use, and a reasonable familiarity with the more important diseases. My plea is not to substitute clinical empiricism for basic principles. Facts are soon forgotten, and, in any case, the so-called facts of today often are the discarded myths of tomorrow. May I quote Osler again: "Superfluity of lecturing causes ischial bursitis." Against the undoubted advantage of the lecture must be cited a serious disadvantage. It conditions the student toward a method of learning which will not be readily available to him during his remaining professional career. When he learns by reading about the problems exemplified by patients he has seen, the opposite is true. He is being taught to utilize a method which will be fruitful throughout his life. One procedure is instruction; the other is education.

It is far more important for a student to understand the Henderson-Hasselbalch equation than to memorize the eponyms of the many ocular signs of thyrotoxicosis. The issue involves the best procedure to create the desire to understand the Henderson-Hasselbalch equation. For this purpose it would appear obvious that the demonstration of two patients with equally elevated blood bicarbonate levels, one of whom has respiratory acidosis and the other metabolic alkalosis, is far more effective than a lecture. The failure of our preclinical and clinical teachers to turn their talents toward mutual efforts to achieve unified objectives is one major reason for the absurdity of the present medical curriculum. Perhaps the most effective ultimate remedy will be long, loud, and continuous protest from the students.

Decision Regarding Size of Medical School

Should we decide to produce many more physicians, we shall have to choose between larger schools, new schools, and new branches of existing schools. Experience at six different medical schools with classes of varying size leads me to believe that a medical school is like an atomic bomb in tending to undergo intellectual disintegration, once a certain critical mass is exceeded. A large number of additional schools or new branches will be somewhat more expensive but will ultimately bring much greater benefits, in terms of the impact of these new centers on the quality of medical practice in surrounding areas. Patients needing complex and highly expensive procedures which are only feasible in medical centers will be able to receive such service nearer their homes if we have many small schools rather than a few large ones.

In the development of new schools every effort should be made to achieve an optimal relationship between them and the practicing profession. Wise institutional policies, coupled with widespread participation in academic activities by well-qualified volunteer teachers, can avoid the unfortunate tensions which have sometimes existed in the past.

Concerning internship and residency training, two principles appear important. Every effort should be made to persuade, but not to compel, men who are entering general practice to secure more than the usual one year's hospital experience. Since the economic factor is the main deterrent, the loan with repayment pledge plan which has been suggested might be valuable in this respect. Schools might encourage two recent graduates located in the same small community to form partnerships, with the two partners returning for advanced training during alternate years.

Some of the specialty boards have begun to introduce more flexibility into their requirements. The schools should encourage this in order that men with different interests may have optimal opportunities to pursue them.

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Aside from these several matters, which are of immediate personal concern to our young Aesculapian, there are broad problems which he and his colleagues must attempt to solve. If they fail in this endeavor they are likely to encounter uncongenial solutions arrived at by others. I am not wise enough to offer definitive solutions but shall suggest certain general principles on which such solutions might be based.

The potential quality of medical care depends on research and education, which determine the upper limits and which are functions of the medical school. However, the actual quality which the public receives depends also on the cost and the availability. The first step in overcoming certain deficiencies in availability is producing more physicians. Economic factors will then aid in the distributional problem. However, these will only become operative after several decades when many more physicians will have been trained and, in any case, are likely to be only partially effective. In the meantime, temporary plans to attempt to attract doctors to small communities are needed and here, as always in medicine, the success of therapy depends on the accuracy of diagnosis.

Problems of Young Physician in a Small Community

The economic barrier to rural practice is no longer a major deterrent, and the lack of facilities, while still important, is lessening as the Hill-Burton program continues. More significant is the personal aversion on the part of physicians, and especially of their wives, to living in small communities. In part, this is based on a lack of good educational and cultural facilities for children. Here the remedy must come from the towns themselves in terms of providing better schools, libraries, and recreational programs. It is unlikely that persons reared in cities will settle in villages, but many men from small towns may be willing to return. Various state legislatures are offering scholarship plans, but the towns themselves should assume responsibility. Communities needing doctors would be wise to provide premedical and medical scholarships for their outstanding high school graduates, with the stipulation that the individual after completing his training will practice in that locality for a specified minimal period. A similar program for young women to be trained as nurses and technologists would reduce that deficit of paramedical personnel, which in itself makes physicians hesitant to settle in rural areas.

Students and interns, when discussing small community practice, often cite one deterrent which many regard as of overriding significance. This is the fear that the intellectual isolation will ultimately lead to professional deterioration. The Academy of General Practice has made valiant efforts to overcome this and deserves more aid from the medical schools than has yet been forthcoming. Those schools which are situated in states with a large rural population should have additional young faculty members who could function as circuit-riding teaching consultants. They could visit the small hospitals and conduct teaching exercises centered around specific patients presenting difficult problems. The number of disciplines represented by these itinerant teachers would depend on the funds available. Radiologists and pathologists would be especially valuable.

The mutual intellectual exchange involved in partnerships and groups tends to combat the professional isolation of small town practice. However, this trend is growing slowly, and in the meantime the various barriers are tending to aggravate the present maldistribution of physicians. Even if we should immediately decide to train many more doctors, several decades would be required before there will be enough for the law of supply and demand to overcome the rural deficit. Stopgap measures are needed.

The serious economic injustices inflicted on our young graduates during their intern and residency years have been mentioned. The following plan might partially remedy this and also serve as a temporary means of supplying doctors to certain communities gravely needing them.

Physicians and other leading citizens of such a small town might form a medical foundation and ask the state medical association for aid. The latter agency could request the medical school to persuade an impecunious resident to practice for one or more years in that community. A portion of the funds earned would be set aside and sent to the medical school as a supplementary salary when the the young Aesculapian returned to continue his specialty training. If he decided not to return but to remain in the rural area these funds would be returned to the local foundation to pay for the equipment which it had initially purchased for the physician. Action by all parties should be voluntary.

To consider in detail the many possible objections and advantages of this plan would lead us far afield. I have discussed it with numerous medical and lay friends. Some have considered it visionary and wholly impractical. Others think it an excellent temporary solution to the present maldistribution of doctors. Still others believe that its possible virtues and defects will only become apparent with trial. With the latter opinion I am in agreement. To Sir Clifford Albutt's dictum that suspension of judgment should not be confused with suspension of thought, we might add that too prolonged suspension of experiment concerning pressing problems may lead to arbitrary and ex cathedra solutions. In any case, it should be emphasized that these proposals are aimed at a temporary solution. When and if, as the result of an expanded educational program, permanent physicians in adequate numbers became established in a community, this extension plan would be withdrawn from that locality and instituted in another area of shortage.

Rising Costs of Medical Care

Perhaps the most difficult problems our young Aesculapian will face will be those involving the costs of medical care and the alternative methods of payment. Few laymen comprehend the reasons for the skyrocketing total national medical expense. This results in widespread blame of physicians and of hospitals. Such censure is occasionally justified but is more often due to lack of understanding.

The general inflation is only one factor and not the most important. Nurses, technologists, and secretaries not only receive much deserved larger salaries but usually now work on the 40-hour weekly schedule. Therefore, more are required to perform the same work. But medical progress has increased enormously the total work to be done. In 1900, blood chemical tests were nonexistent in hospitals. In 1920, only some half dozen different tests were done, and even these were available in few hospitals. Now almost every hospital performs 20 or more different blood chemical tests, and in the leading institutions several score are available. Thus, the number of medical technologists needed has increased tenfold. As the complexity of these procedures has increased the skill and hence the training required to perform them accurately has also risen.

During the past 30 years the number of electrocardiograms taken has increased at least 10 times, and standard records require 12 leads instead of 3. Thus, the total technician-hours required for providing modern electrocardiographic service to a given number of patients has risen by several thousand per cent. Similar increments in radiologic, nursing, and other medical services could be cited.

Contrary to the widely accepted opinion, these advances have not decreased the amount of time a physician needs to devote to a given patient. In the ease of the superior doctor, they have increased it. He wishes to see personally the x-rays and electrocardiograms of his patients. Likewise, he has to read a large number of additional journals in order to know which tests to order and how to interpret the results. Furthermore, he knows that laboratory procedures, valuable as they are, must be integrated into the total clinical pattern. He, like Dr. Major, realizes that the meticulous history and the thorough physical examination remain the *sine qua non* of accurate diagnosis and that without them these additional procedures are often useless and occasionally misleading.

The astonishing medical advances of the past several decades have thus not reduced the time required of physicians. Rather they have increased it and have made it much more effective. The proof is the 20-year increase in life expectancy during the present century. The advances in preventive medicine and the steady increase in the complexity of the facilities and in the number of medical man-hours required for diagnosis and treatment has led not only to a great advance in the quality of medical care but also to rising expense. The physician who explains these matters to his patients will receive fewer complaints about the cost of hospital and other medical services.

Even these factors are not the most important ones in the rapidly expanding total national health costs. Probably the greatest single reason is the aging of the population. Persons beyond the age of 60 years have much more chronic illness than persons under 40. The man who does not die of lobar pneumonia at age 35, but lives to have three episodes of myocardial infarction and ultimately dies at age 75 of congestive heart failure after numerous periods of hospitalization, has indeed incurred a large additional medical expense. He has also gained 40 years of life, for which he is indebted not only to his physician and to his hospital but also to those who trained his doctor—and to Alexander Fleming who discovered the penicillin which prevented death from lobar pneumonia.

These considerations indicate that the chief culprit responsible for rising costs is medical progress. It not only brings new, elaborate, and expensive methods of prevention, diagnosis, and cure but leads to more older persons with more chronic illness. Perhaps a third of our total annual expenditure for health purposes (about 18 billion dollars) goes to care for the chronic illness of people who in 1900 would not have been alive because they would have died from an acute disease which now is either prevented or cured. If this estimate is correct, each citizen of the United States is paying annually less than 40 dollars in return for an average of 20 more years of life. Can anyone suggest a better way to spend our money?

Types of Medical Expenses and Suggestions for Coverage

In terms of economic gravity medical costs are of three types (table 2). There are the multiple small weekly or monthly expenses for services of physicians or of dentists and for drugs, or for a single brief hospital admission. The annual total of such small expenses for the average American family is somewhat less than two weeks' income. We may designate such expenditure as inconvenient.

The second type of cost is that illustrated by multiple short periods of hospitalization for a single family within a given year, or by one prolonged period involving one or more operations and the services of several physicians. Such expense, which may readily be the equivalent of several months' family income and is truly devastating if the pano more than the cost of a new automobile, it is unpredictable and burdensome while not truly catastrophic. We may call such outlays stressful.

The third type of cost is represented by chronic diseases, such as certain mental disorders, which necessitate prolonged hospitalization over a period of years. The total expense may exceed the annual family income and is truly devastating if the patient or his family has to pay it.

We may now consider the most effective method of meeting these several types of expense. The case for direct, out-of-pocket payment of inconvenient costs is, in my opinion, overwhelming. To utilize insurance for this purpose is highly inefficient because the administrative and bookkeeping costs may readily exceed the medical expense. Furthermore, as long as we have a serious shortage of health personnel, some economic barrier is needed to prevent idle, curious, and neurotic persons from utilizing so many medical man-hours that those who are gravely ill may fail to receive the time they need.

The great advantage of insurance as a method of payment is its cost-spreading aspect. The time spread over a period of years might be met by a postpayment installment method similar to that commonly utilized in purchasing automobiles and appliances. However, the group spread cannot be achieved in this manner and the unpredictability of illness, both as regards occurrence and cost, make this group spread highly desirable.

Insurance has serious drawbacks, aside from its already mentioned inefficiency as a means of covering repeated small inconvenient costs. Thus, if it is to meet the devastating outlays of serious illness lasting for years, the expense of premiums will be beyond the means of many families in the lower income groups. Unless the widely utilized but unpopular features of deductibles (preliminary direct payment by the patient before being eligible for insurance benefits) and coinsurance (continued payment by the patient of a fraction—usually about one-fifth—of the costs) are preserved we shall inevitably continue to have unnecessary hospital admissions and needlessly prolonged stays. Human nature being what it is, there is probably no method of preventing abuse except an economic penalty. The problem is to have a penalty which minimizes abuse and at the same time is not too stressful for those who genuinely need repeated or prolonged hospitalization.

The overutilization of hospitals which has resulted from insurance programs tends to create a serious shortage of hospital beds. This at times causes injustice to those gravely ill patients who urgently require admission. It, likewise, means greater long-range expense to the public for premiums and for construction of additional hospital facilities.

These defects in our rapidly expanding health insurance system can be overcome by proper safeguards. The problem is to convince the public that it is to its long-range interest to purchase policies which embody these safeguards. I gather that our friends in the insurance business are making progress in this endeavor which merits our strong support. In any case, the net effect of voluntary health insurance has been decidedly good, and it is particularly well adapted as a means of payment of the stressful costs.

When we turn to illness involving devastating expense, neither insurance nor direct payment offers an adequate solution. Fifty years ago the chief chronic disorders requiring prolonged institutional treatment were tuberculosis and mental disease. The general principle that taxation should meet the expense of these disorders has been defended by the medical profession and long accepted by the public. It would appear logical to extend this concept to include other chronic diseases which involve overwhelming outlay.

The general principles suggested are as follows: Whether a given illness or a series of diseases involves inconvenient, stressful, or devastating expense varies according to family income. Therefore, insurance policies for different income groups should involve varying deductibles and different duration of benefits. The attempt should be to have the beneficiary become eligible for insurance only after he has met the inconvenient costs by direct payment. Once the expense becomes truly stressful the major fraction, but not all, should be paid by insurance. The illness which involves a genuinely devastating cost would be paid for by tax funds, the patient who has already paid directly and then utilized his insurance being considered as medically indigent during this period.

TABLE 2.—*Optimal Relationship Between Cost and Payment**

Type of Cost	Upper Limit of Total Expense†	Most Socially Desirable Type of Payment	Medical Care Provided by
Inconvenient numerous small outlays	2 wk.'s family income per yr.	Direct-fee for service	Practicing physicians
Stressful: e.g., expensive hospitalization	1 yr.'s family income	Voluntary insurance 80%†; direct 20%† (to prevent abuse)	Practicing physicians
Devastating: e.g., mental disease; some other chronic diseases	More than 1 yr.'s family income	Taxation‡	Medical school faculties

* These relationships would not apply to those who are either very wealthy or totally indigent.
† Figures are arbitrary and selected only to illustrate the general principle.
‡ Logical extension of a principle long accepted for tuberculosis and mental disease.

Those patients who were receiving tax-supported care might well be treated in university hospitals and in adjacent nursing homes. This care would include necessities but no luxuries such as private rooms. It could be provided by interns and residents aided by students and supervised by members of medical school faculties. Thus, the medical schools would have ample patients for teaching and, subject to appropriate safeguards, for research. Full-time teachers would be concerned with private patients only insofar as they were referred by private physicians in the light of such especial facilities and procedures as would not be otherwise available.

These suggestions are not aimed at a standardized national program. It would be much better if such state medical societies and legislatures as might desire to institute pilot plans adopted vary-

ing definitions of inconvenient, stressful, and devastating costs. The experience so gained might ultimately lead to a broader program which preserved our present medical pattern for the vast majority of patients and still provided for the exceptional illness for which neither direct nor insurance payment is well adapted.

Some population groups are desirous of complete prepayment for all medical services, believing that the removal of the economic barrier represents the only method of achieving early diagnosis and preventive care and that such a program would remove temptation to seek unnecessary hospitalization. As long as such programs are limited to relatively small population groups and are conducted in communities where there is no shortage of medical personnel they would appear to have the virtue of an experimental approach to a difficult problem. We shall ultimately learn much from such experiments.

There is a serious and, indeed, overwhelming objection to the rapid extension of these prepaid plans to a major segment of the population. Some of the disadvantages are that many doctors do not like it; it encourages unnecessary medical attention for minor ailments; it encourages assembly line mass medicine rather than detailed attention; however, superior physicians can, and do, avoid this.

Preventive care implies early diagnosis, which is often a most difficult and time-consuming task. Routine examination of urine, measurements of blood pressure and blood sugar levels, chest films, and electrocardiograms will detect some disorders in an early stage. Most diseases are more elusive than this and, especially when incipient, will be recognized only by the most exhaustive history and physical examination supplemented by many roentgenograms and special tests. Therefore, preventive care for a large segment of the population would subtract many medical man-hours from an already too-small pool. The net result would be a further decrease in the available personnel to provide the more urgent curative care for the remaining population groups. Thus, the large scale approach to preventive care must necessarily be deferred for several decades until the existing shortage of physicians and of other health groups has been overcome.

Conclusions

Medicine exists to serve the public. The public will be poorly served if programs are adopted which tend to drive adventurous young minds into other fields. It will be best served if we keep what we have that is good and apply the experimental method to the solution of those problems which involve only a minority of patients but which are of such gravity as to create deep social unrest. Of numerous experimental approaches which might be devised, I would suggest one: that we attempt to turn over to the medical schools those areas, whether economic, geographical, or professional, in which our otherwise good system of practice is not functioning effectively. The expense of so doing, while large, relative to present medical school expenditures, will represent a small fraction of our annual national health cost.

There is nothing radical about these suggestions. They are along traditional lines. Hippocrates, who advocated and exemplified the synthesis of research, education, and service in the solution of the problems of medicine in ancient Greece, set the pattern which might furnish the answer to ours.

Medicine has been good to me. It has brought recognition beyond my merits. More important, it has provided threefold satisfactions. Aside from the rare but strong thrill of a new idea, there has been the occasional tear of gratitude in the eye of a patient. Perhaps the greatest, and certainly the most frequent, satisfaction has been the gleam of comprehension on the face of an inquiring pupil. But there are many frustrations in the academic life. The knowledge that one could always set up his own shop and be master of his own destiny has been a constant refuge. On two different occasions I have done so, only to be lured back to the academic rocks by those twin sirens—the unsolved research problem and the desire to teach. This in turn has sometimes caused envy of the foresight of Ulysses, who poured wax in the ears of his sailors that they might be deaf to the sirens' call.

The hope that future generations of young physicians will have the same freedom of choice which has been available to me is tinged with the opinion that if we do not find our realistic answers to difficult questions, some other group will achieve theirs, to the long-range detriment of patients, because of declining quality of those who seek medicine as a career.

These, then, are some of the problems which our young Aesculapian faces. In order to approach them he needs to visualize the future. The present is only one point and through it can be drawn numerous lines diverging in all directions. Familiarity with the medicine of the past furnishes the second point necessary to project a single line toward the future. This is the practical value of the scholarship of Dr. Major and of his fellow students of medical history. You, who are beneficiaries of his labors, are in a favored position to obtain a clear focus on present and future problems. You may wish to follow Browning's advice that young people should "strive . . . toward making" rather "than repose on aught found made." It is my hope that you will ponder these matters, will conduct experiments, and then adopt not my solutions but your own.

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MEDICINE AT WORK

PREVIEW OF TOMORROW . . .

. . . **A. M. A. Scientific Activity**
. . . **Progressive Care Spreads**
. . . **Induced Creativity**
. . . **Tighter Discipline**
. . . **FDA's $2,000,000 Plan**
. . . **Ready for the Invisible**
. . . **At Home in Space**
. . . **How Deadly the Thought —A Special Report**

Anatomy of a Doctor

Suppose a friend's son is contemplating a career as a physician; could you explain what it's like to undertake medicine as a way of life?

One physician's description recently appeared as an editorial in the Lackawanna County (Pa.) Medical Society Bulletin.

"[It takes] many things. Long years of professional training—unique and rigorous. The willingness to devote time, day or night, to someone in need of services. The ability to make decisions with full knowledge that a human life may be at stake.

"The man who chooses medicine as his career is still studying long after his contemporaries are established and earning a living: premedical education, medical school, internship, residency, possible specialization. [Then] an office—with costly instruments and equipment so that patients may get the best medical care he can give them.

"Ever-changing, ever new, medicine is the least static of the professions or the arts. And its practitioners must continue their medical education throughout their careers.

"The doctor must also . . . use his knowledge and his understanding to allay the emotional overtones of illness. Reassurance and sympathetic interest can often lighten the physical burdens of illness immeasurably.

"And finally the doctor must . . . make good health a commodity to be retained rather than restored."

A. M. A. Scientific Activity— Its Past and Its Future

The objects of the Association are to promote the science and art of medicine and the betterment of public health.
Constitution of the A. M. A.

For more than 100 years the A. M. A. has pursued these stated objectives. As the Association grew, so did the organizational machinery through which it sought to aid and encourage these purposes. Next week 20 of the nation's outstanding physicians and scientists will meet in Hershey, Pa., in an attempt to evaluate past A. M. A. scientific efforts and to chart a course for the future.

Scheduled to meet Sept. 14 through 16 with the guest scientists in Hershey will be members of the Board of Trustees, chairmen and staff personnel of the committees and councils of the Division on Scientific Activities, and directors of other A. M. A. divisions.

Guests will represent a wide variety of disciplines, including physiology, pathology, sociology, radiology, biochemistry, neurology, mental health, and preventive medicine.

After an initial plenary session, the group of 60 or more participants will be divided into five or six small groups. In individual meetings these will consider important scientific issues in such areas as formal medical education, continuing education, basic and clinical medical science, and sociological implications. Reports of the smaller groups will then be reported and discussed at a second general session. The conference will close with a report of its findings and recommendations.

Commenting on the conference, the first of its kind in A. M. A. history, Dr. Edward L. Turner, director of the Division of Scientific Activities, said, "We have a real hope that out of this will come suggestions and recommendations as to how an organization such as the A. M. A. can realize maximum potential to be of assistance to the medical profession in the conduct of scientific activities."

Participants are listed on next page.

Sparks fly and Fido gets it in the end. A special report on page 182 delineates a medical challenge—the communicability of attitudes and ideas. (Also see editorial on page 188.)

Participants at Hershey

Scheduled as guest participants in the scientific assessment conference (see story on previous page) are Drs.:

C. N. H. Long, chairman, department of physiology, Yale University.

John Millis (Ph.D.), president, Western Reserve University.

Shields Warren, pathologist, Harvard University.

Robert F. Loeb, professor of medicine, Columbia University.

Leo W. Simmons (Ph.D.), professor of sociology, Yale University.

William R. Willard, dean, University of Kentucky Medical School.

Thomas B. Turner, dean, Johns Hopkins University School of Medicine.

Roger A. Harvey, professor of radiology, University of Illinois.

Marshall Brucer, chairman, medical division, Oak Ridge Institute for Nuclear Studies.

Conrad Elvehjem (Ph.D.), president, University of Wisconsin.

John A. D. Cooper, associate dean, Northwestern University Medical School.

Lowell T. Coggeshall, dean, division of biological sciences, University of Chicago.

Kendall Corbin, professor of neurology, Mayo Clinic.

Willard C. Rappleye, president, Josiah Macy Jr. Foundation.

William Malamud, director of research, National Association for Mental Health.

C. Nash Herndon, professor of preventive medicine and medical genetics, Bowman-Gray Medical School.

Percival Bailey, director, Illinois State Psychiatric Institute.

William B. Hildebrand, former president of the American Academy of General Practice.

Herbert Longenecker (Ph.D.), vice-president, Chicago Professional Colleges, University of Illinois.

Jack D. Myers, professor of medicine, University of Pittsburgh Medical School.

Some FDA Plans Are Previewed by A. M. A. Council

Foods, pesticides, hormones, and medical fakirs are in for some special attention in the months ahead because of an added 2-million-dollar appropriation voted by Congress recently for the Food and Drug Administration.

That's the word from FDA Commissioner George P. Larrick. He described the medical and related activities of his federal agency on Aug. 2 at a Chicago meeting of the A. M. A. Council on Legislative Activities, whose 13 members come from every region of the country. The Council is sometimes described as the most sensitive group of the A. M. A.—most sensitive to the same "typical U. S. doctor" opinion which ultimately lies behind every action of the policy-making House of Delegates. (See Organization Section, THE JOURNAL, May 3, 1958.) Every Council recommendation is subject to action by the Board of Trustees.

Larrick's comments were received in between six hours of Council agenda whose topics ranged from the Forand bill to automobile safety devices, from atomic energy to public health training. He informed the members that the extra appropriation for FDA means intensified activity in at least a half-dozen fields:

1. Closer surveillance of pesticides. A $325,000 crop of spinach had to be destroyed recently because of danger to the consumer from a double dose of DDT. "And each year we seize thousands of tons of food infested with rodents or insects."

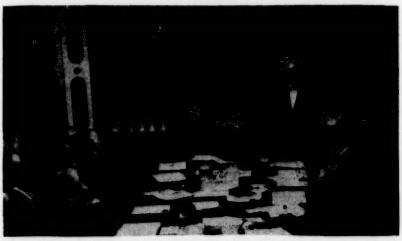
2. Additional studies of beneficial and harmful effects of radiation on foods.

3. Investigations of possible carcinogens in the waxen linings of certain types of food containers.

4. Tests for possible toxic effects from the reuse of fats in preparing such foods as potato chips.

5. A closer watch on spoilage from the thawing of frozen foods before they reach the consumer.

6. A broad assay of hormone preparations.



A. M. A. Council on Legislative Activities hears FDA Commissioner George P. Larrick (*standing*) describe new plans of his agency in the year ahead.

In particular, Larrick told the Council, quacks will be more hotly pursued than ever before. "We know of 1,500 practitioners in the so-called healing arts who use quack materials or quack methods—often in cancer-scare operations. The fact that every fakir in the country curses the FDA and the A. M. A. in the same breath is a good sign that we are on the right track."

The Chairman of the A. M. A. Council on Legislative Activities is Dr. George M. Fister of Ogden, Utah, who is also a member of the Board of Trustees. Other Council members are Drs. McKinnie L. Phelps of Denver; David B. Allman of Atlantic City, N. J.; C. Byron Blaisdell of Asbury Park, N. J.; R. B. Chrisman Jr. of Coral Gables, Fla.; Frank C. Coleman of Des Moines, Iowa; Frank J. Holroyd of Princeton, W. Va.; J. Lafe Ludwig of Los Angeles; Harlan English of Danville, Ill.; John E. McDonald of Tulsa, Okla.; Martyn A. Vickers of Bangor, Maine; Raymond L. White of Boise, Idaho; and George E. Twente of Jackson, Miss. Mr. C. Joseph Stetler is staff secretary.

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The Invisible Invaders

Chemistry, Biology Join Nuclear Physics in the CD Curriculum

Since the white helmet and stirrup pump days of 1940, the federal government has issued many kinds of civil defense equipment. From whistles to steam shovels, from brassards to radiation counters, it has doled out material designed to defend the United States civilian. But this month, for the first time, the government will release one item never before seen on local CD equipment lists: gas masks.

Although the 40,000 protective masks available in Office of Civil and Defense Mobilization stockpiles are sufficient for little more than demonstration purposes, to the A. M. A. Council on National Defense the move is indicative of a change in federal thinking which its members heartily approve. Last May, impressed with a sense of urgency in educating the American public to the dangers of chemical and biological weapons, the Council voted a resolution calling on OCDM to seek declassification of secret information on defenses against BW and CW, as they have come to be known. The resolution also called for a "realistic" educational and training program in detection, decontamination, and other protective measures.

It was this same sense of urgency that early this year led the Council's Committee on Disaster Medical Care to ask the Army for high-level briefing on germ and gas warfare, a request that culminated in its members attending a day-long session in March at the Chemical Corps research center at Fort Detrick, Md.

Their report to the Council spurred passage of a resolution requesting that OCDM "take appropriate action to have . . . information declassified and released to the public" and that consideration be given to the development of a realistic educational and training program dealing with detection, decontamination, and other protective measures against chemical and biological warfare, including the stockpiling of supplies and equipment.

Detection and Therapy

Much of what the doctors learned at Fort Detrick is still secret, but even the small amount of declassified information indicates some weighty problems:

—Detection of biological material disseminated by an aerosol is a difficult matter. Charles Phillips, Chemical Corps scientist, told the Committee, "It does not give out those mysterious things called alpha, beta, and gamma rays. It does not whistle or . . . anything. It just floats around. The aerosol particles contain a little protein, a little carbohydrate, some fat, and common mineral salts. You would get about the same thing if you took a little steak and ground it into micron-sized particles."

—Although atropine and artificial respiration may successfully revive a patient exposed to otherwise lethal doses of anticholinesterase, a possible weapon substance, distribution and quick employment of these remedies is quite another matter. Lieut. Col. Douglas Lindsey, physician and deputy director of medical research for the Army Chemical Warfare Laboratory, said, "We can protect against 30 [to] 50 times the amount needed to kill, but where are these enormous supplies of atropine? Who will get to these casualties in minutes and give intravenous injections? How many patients who need effective, prolonged artificial respiration will get it?"

—Recently graduated physicians are deficient in their knowledge of infectious disease, according to Col. W. D. Tigertt, commanding officer of the medical unit at Fort Detrick. Colonel Tigertt says this is a result of the low incidence of these diseases in teaching hospitals, and the necessity for increased emphasis in the curriculum on such problems as heart disease, cancer, and geriatrics. Col. Tigertt believes that "the absence of firsthand knowledge by our medical people lends an air of mystery to these infectious diseases. This inexperience might be communicated to patients and possible patients, undermining their confidence in the capability of the medical profession."

Things to Come

In answer to the Council's request for the release of presently classified information on chemical and biological defense, OCDM Director Leo Hoegh says such an effort is under way. In a letter to the Council he writes, "Much classified and unclassified material dealing with the subject is available. This material is now being organized by the Department of Health, Education and Welfare and will be made public as rapidly as possible."

American antipathy toward chemical and biological weapons and the consequent difficulties of preparing an adequate defense against their use strike some as peculiar. One U. S. Army Research and Development officer expresses it this way: "It's curious how society is willing to burn people alive on the battlefield, bomb civilians to bits, [and] contaminate whole areas with radioactive fall-out, and yet when somebody mentions the possibility of poisoning the enemy's food supply or subduing whole armies with a so-called fear gas, he is promptly shredded by public opinion; his ideas are [condemned as] savagely uncivilized."

Dr. Harold S. Diehl of New York is chairman of the A. M. A. Council on National Defense. Other members are Drs. Reuben A. Benson of Bremerton, Wash.; Carroll P. Hungate of Kansas City, Mo.; Perrin H. Long of Brooklyn, N. Y.; Harold C. Lueth of Evanston, Ill.; Walter B. Martin of Norfolk, Va.; Richard L. Meiling of Columbus, Ohio; David Henry Poer of Atlanta; and Herbert B. Wright of Cleveland. Mr. Frank Barton is staff secretary.

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How Good Is Doctor Discipline? Medicine Seeks an Answer

How well are the public and the profession being protected against those who practice the healing arts in a manner that is immoral, unethical, or downright illegal?

This is the basic question behind a series of fact-finding interviews now being made by staff members of the A. M. A. Law Division, with state medical associations and state boards of medical examiners. The visits were requested by the A. M. A. Medical Disciplinary Committee, formed late last year by the Board of Trustees (see Medicine at Work, THE JOURNAL, May 23, 1959).

The Committee is charged not only with determining the adequacy of disciplinary laws, rules, and procedures, but also with checking the effectiveness of these mechanisms. A simple listing of rules is one thing, but finding out how well they function under the stress of actual situations, and to what degree man's fallibility may distort their idealistic purposes, is quite another.

Meeting in Denver July 23, the Medical Disciplinary Committee decided that a survey of regulations and procedures might be carried out by mail. At the same time, however, it approved a plan of personal visits by attorneys of the Law Division, in hopes that such face-to-face contacts with those close to disciplinary matters will provide greater insight into any difficulties with present provisions.

That there are difficulties inherent in present arrangements was demonstrated on a small scale during the Denver meeting when the executive secretaries of several state medical associations, together with the secretaries of state boards of medical examiners, told of some of the disciplinary problems they have encountered. For example:

—One state was faced with a physician still practicing five years after his license had been ordered revoked, simply because the matter was still pending in the courts on appeal.

—State A still has a physician practicing under a license granted on reciprocity from state B, despite the fact that state B has since revoked the original license because of fraudulent credentials.

—A third state was on the verge of granting a medical license to an applicant when it found by chance that another state had revoked an earlier license.

These and similar incidents form the Committee's field of study. Do they result from a lack of method for eradicating them or through faulty usage of mechanisms available but improperly implemented? The Committee's future actions and recommendations will depend on the answers to these questions.

Members of A. M. A. Medical Disciplinary Committee meeting in Denver listen intently as guests describe some difficulties encountered in resolving problems of physicians' conduct.

Included in the Committee's statement of purposes, adopted by the Board of Trustees and the House of Delegates, are these:

—To determine whether the A. M. A. could or should become more active in guiding and participating in matters relating to medical discipline.

—To recommend appropriate measures to improve the over-all mechanisms of equitable medical discipline.

—To recommend and draft, if necessary, based on the results of thorough studies and investigations, new legislation or amendments to existing legislation . . . or additional procedures for medical societies, in order that the quality of patient care may be improved by maintaining adequate standards of medical discipline.

What sorts of charges bring a physician face to face with his state board of medical examiners for possible discipline? That's one thing the Committee is now trying to find out, but the secretary of one state board offered a clue at the Denver session. Of 20 cases recorded in his state since 1933, one had been based on activities while suffering from alcoholism, 2 on purported illegal abortion, and 17 on suspected narcotics addiction.

Chairman of the A. M. A. Medical Disciplinary Committee is Dr. Raymond McKeown of Coos Bay, Ore. Other members are Drs. James H. Berge of Seattle; Paul G. Henley of El Dorado, Ark.; H. Thomas McGuire of New Castle, Del.; and E. G. Shelley of North East, Pa. Staff secretary is Mr. C. Joseph Stetler of Chicago.

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PPC—A Plan in Denver And a First in Chicago

The growing trend toward Progressive Patient Care has reached widely separated hospitals in recent weeks. (See Medicine at Work, THE JOURNAL, April 26, 1958.)

Plans are under way for a new 8-million-dollar hospital embodying PPC principles in Denver. The block-square facility for the Sisters of Mercy of Colorado will stand on the present site of 58-year-old Mercy hospital, one wing of which will be converted into apartments and a "hospital home" for elderly persons needing some medical attention. The new eight-story building, with 500 beds, will be divided into "intensive," "intermediary," and "convalescent" care units. The patient's physician will determine which unit best accommodates his medical need at different stages of recovery. Late last month a general session on PPC was held during the annual meeting of the American Hospital Association in New York City.

For the first time in Chicago, meanwhile, Progressive Patient Care is now in operation. Since July 9 patients at Grant hospital have benefited under a continuum of treatment in units labeled "intensive therapy," "general care," and "ambulatory or self-care." In calling for realistic use of the units by physicians, in line with improvements in patients during their hospital stay, Dr. William A. Hutchison, medical director of Grant hospital, said:

"If the Blue Cross Plan had not agreed to support our Progressive Patient Care program it is doubtful that it would have a chance to succeed. This support, however, is on a trial basis, and after six months the entire program will be reviewed by the hospital and Blue Cross."

Laymen, too, join discussion in Denver as A. M. A. Committee on Insurance and Prepayment Plans sponsors regional session devoted to betterment of group health plans.

Improved Health Insurance— Goal of the Determined Doctors

"Gentlemen, you cannot afford to fail. If your organizations cannot find answers to these problems, we are in for real trouble."

The speaker is Dallas Cook of the Denver Chamber of Commerce. The problems he refers to are those confronting voluntary health insurance plans today. The organizations are Blue Cross, Blue Shield, the Health Insurance Council, and the American Medical Association.

Mr. Cook was one of a dozen or more laymen invited by the A. M. A. Committee on Insurance

Recycle Built for Two

The first space cabin simulator of its kind in the free world, in which two men can live for as long as 30 days in total isolation, is scheduled for completion this month in Minneapolis.

In photo at left, Lt. Col. George R. Steinkamp, M.D., Chief of the Department of Astroecology at the Air Force School of Aviation Medicine, inspects the 7-ton device which will be "home" for two Air Force volunteers during the first U. S. experiment in long-term simulated space flight. Previous tests were for shorter periods in a one-man cabin (see Medicine at Work, THE JOURNAL, June 15, 1957, and Jan. 31, 1959).

The two "astronauts" will breathe and rebreathe the same air and drink and redrink the same water. Urine and all other forms of waste water will be "recycled"—purified by a process which includes chemical treatment, filtering, superheating, freezing, and final filtering through activated carbon. Human feces and other solid wastes like hair and food particles will be dehydrated and incinerated, and the gases produced will be disposed of with an afterburner.

and Prepayment Plans to its third regional conference in Denver, July 25-26. It also attracted more than 50 physicians of the intermountain area that stretches from Wyoming to New Mexico. A similar conference was held a week later in Portland, Ore.

Facing such health insurance difficulties as rising costs, misuse, increasing demands by subscribers, and the threat of government intervention, few of the assembled doctors would have quarreled with the Denverite's assessment of their position, but there was no faintheartedness, either. For each difficulty there seemed to be a possible remedy, for each demand a feasible method of satisfying it.

Take the matter of organized labor's requests for comprehensive health insurance coverage. Dr. Paul Clayton, president of the Utah State Medical Association's medical service bureau, thinks Utah has an answer. He says, "We have little trouble with labor because we give them what they want—at a premium. We don't cover home and office calls yet, but we could if they'd pay for it. Sure, they'll gripe about costs, but they see the justice of them too. They understand the present cost of hospital care because they know 70% of it goes for labor."

"Scared to Death"

Or listen to Dr. Bernard Daniels, trustee of the Colorado State Medical Society: "Four years ago labor had us scared to death with talk of building diagnostic clinics and hospitals in Colorado, but so far they haven't constructed a single facility. When they looked into the cost of building and operating these things they began to take a more realistic view of the price of voluntary insurance."

Mr. Albert Whitehall, director of health insurance for the Life Insurance Association of America, thinks one of the present needs is to educate both labor unions and the general public to the advantages of voluntary health insurance systems. He said, "Labor is dubious of medicine's ability to control the quality of medical care and its cost. It's up to us to prove to them that the patient who pays the physician is in the best position to control his own medical service."

Education was much on the mind of another participating physician, too, although in a somewhat different form. Dr. John F. Burton, chairman of the A. M. A. Committee on Indigent Care, said, "Perhaps we have overemphasized health insurance for the aged. Local, county, and state welfare organizations need to be shown that these people often have a need which may be critical but only temporary. Many of them can pay for ordinary medical care, but it is the catastrophic illness that makes it difficult. Give them help through this period."

Overemphasized or not, health insurance is becoming increasingly available to the elderly. This was the report of Dr. Donald Stubbs, a member of the Committee on Insurance and Prepayment Plans, who told the Denver audience that "nearly 92% of all persons holding 'Blue' plan memberships now reside in areas where special insurance plans for the aged are either now in effect or soon will be."

Fees: Theory and Practice

Who sets a doctor's fees? Not the individual physician, says Dr. Lewis Overton, president of the New Mexico Medical Society.

"Whether you will admit it or not," he told the assembled physicians at the Denver regional conference on insurance and prepayment plans several weeks ago, "the community in which you practice pretty much governs what your fees will be."

Dr. Overton made the observation during a discussion of relative value studies. He said, "We must not feel that by accepting relative value schedules we are giving away a prerogative exclusively our own."

Attitudes of Physicians

Just as important as any of these, and perhaps vital to the success of voluntary health insurance, are the attitudes of physicians who control the use of such insurance. Many of the conferees spoke strongly of the need for impressing physicians with the economics of health insurance, and many told of methods their societies had used in attempts to spread the word.

The Kansas Medical Society, said Oliver Ebel, its executive secretary, has formed a committee charged with orientation of physicians. The state has been divided into districts, and plans call for each newly licensed physician to be visited by either a member of the committee or a state society official, with a view to explaining such matters as health insurance.

Dr. Milford O. Rouse, member of the Committee from Texas, said any new member of the Texas Medical Society holds only a provisional membership until he has completed a one-day orientation at the society's headquarters.

Oklahoma, according to Dr. Burton, has found that its plan of preceptorships has done much to teach young physicians about such matters as medical economics as well as medical practice.

The Colorado Medical Society hopes similar educational benefits will be the result of its active liaison work with the Student American Medical Association, whose state officers are sent to the A. M. A. Annual Meeting at state society expense.

The conference produced no formula guaranteed to cure all the aches and pains that beset voluntary health insurance, but it did give those in attendance a glimpse of the methods being used by others to alleviate some of the difficulties. And such meth-

ods are imperative, according to Dr. Stubbs, who warned: "We are trying to hold off bad solutions to the problem of health insurance coverage, but this in turn demands that we come up with a good solution of our own."

Chairman of the A. M. A. Committee on Insurance and Prepayment Plans is Dr. Carlton E. Wertz of Buffalo. Other members are Drs. Percy E. Hopkins of Chicago; W. Vinson Pierce of Covington, Ky.; Milford O. Rouse of Dallas, Texas; and Donald Stubbs of Washington, D. C. Staff secretary is Mr. George W. Cooley of Chicago.

RV Seems OK in Most Of the Northeast

Like the patio and the sports car, the Relative Value Study is a California export that appears to be gaining wide acceptance in the East. This was indicated on July 18 when a straw poll showed that, of seven northeastern state medical associations, only two—Rhode Island and Massachusetts—saw no immediate need for RV. The rest are either already at work on such studies or are planning in that direction.

The poll was made in Boston during the second regional discussion session on Relative Value Studies held by the A. M. A. Committee on Medical Practices. The first session was held last spring in San Francisco (see Medicine at Work, THE JOURNAL, March 21 and May 23, 1959), and a third was scheduled for today in Indianapolis.

Purposes of the regional sessions are to explain what Relative Value Studies are (a unit system for relating the value of one medical procedure to others based on the time, skill, effort, and experience required to perform it), and to offer all help possible to state associations desiring to establish their own studies.

More than 100 physicians, society officials, and Blue Shield and insurance company representatives met to hear Dr. Francis J. Cox, a veteran of California's pioneering, give a detailed explanation of the why and how of RV studies and to ask questions about uses, acceptance, cost, and difficulties.

Dr. Cox sought to impress his audience with the need for considering the importance of Relative Value Studies. He said, "We are here because of a social and economic revolution in the United States, and since we are citizens, we have to live with it. If we are going to be presented with pooled funds to pay for the costs of medical care, we will have to develop some method . . . to determine how these dollars are to be disbursed."

Chairman of the House of Delegates Committee on Medical Practices is Dr. Lester D. Bibler of Indianapolis. Other members are Drs. James P. Hammond of Bennington, Vt.; Elmer G. Shelley of North East, Pa.; J. S. DeTar of Milan, Mich.; and James M. Kolb of Clarksville, Ark. Mr. George W. Cooley is staff secretary and Mr. Murray Klutch is research associate.

They Cover a Continent to Bring Doctors Closer Together

The A. M. A. Division of Field Service, as Director Aubrey Gates sees it on its first birthday this month, is a sort of mutual understanding society for organized medicine. He says, "We try to learn more about the problems of state associations, and we acquaint them with situations in other states and at headquarters. We are also trying to work cooperatively with members of Congress and lay groups."

His four field men—all veterans in the activities of organized medicine—have spent much of their first year getting acquainted in their territories. With 12 states apiece, they have visited most of the states three or more times. This has entailed considerable travel, since Mr. Gates uses a scattergun approach in making assignments.

A field man may have a territory that ranges from a chill New England state to one in the far Southwest, and from the mountain vastness of Utah to the endless plains of Kansas. This geographic potpourri is designed to prevent the four—Rueben Dalbec, Glenn Gillette, Charles Johnson, and Richard Nelson—from acquiring a biased outlook based on specific regional problems and attitudes.

Washington veterans Cecil Dickson and James Foristel, together with D. Harold Slater, a former newspaperman, form the legislative arm of the Division in Washington, D. C.

Much of the Division's recent work has been in connection with the Forand bill, but legislation is only one of many Field Service interests. Its other duties include detecting criticism of the A. M. A. for the guidance of management, locating points of friction in organized medicine and aiding in their correction, promoting A. M. A. services to physicians and laymen, and helping doctors to recognize their identity of interest with the A. M. A.

In a few weeks, on Oct. 2 and 3 in St. Louis, the Field Service will join the Law Division in its first "Key Man Conference." Invited to the session will be three men from each state society, including the executive secretary. Discussions will center on legislative activities, state and national liaison, and working methods.

As the first year of operation ends, Director Gates can look back on some problems already solved and ahead to others still needing attention. Among the more vexing questions of the future is which man to assign to the new state of Alaska—or better yet, Hawaii.

How Deadly the Thought

Exploring Communicability Of Ideas and Attitudes

Milton Golin

In Peiping, China, mobs stoke the coals for another "hate America" blast. Remember the Salem witch hunts of 1692?

In Little Rock, Ark., the word is snickered from neighborhood to neighborhood that "things are going to happen" at Central High School when the new semester opens. Remember the panic-laden 1938 Orson Welles radio program which told more than a million Americans that they were being invaded by Martians?

In a Minnesota prison, six men serving life terms for particularly violent murders expose identical scars to a medical survey team—each had been beaten viciously during early childhood by one or both of his parents. Remember that line from Proverbs 22:6, "Train up a child in the way he should go; and when he is old, he will not depart from it"?

Whether it foments hate in a nation, fans bigotry or panic in a community, or spawns violence in an individual, the infectious brain of man is at work.

Try tracing the yelps of a kicked dog to the chain reaction which began when its master was bawled out by the boss (see drawing). Try explaining how it happens that a seven-year-old girl is too upset to eat lunch because her teacher was reprimanded that morning by the principal who had a tiff with his wife at breakfast. Who catches what from whom, and how is it passed on, and what is the true extent of injury?

The question, whether contemplated silently in shame or screamed in agony, exposes one of medicine's most important unsolved problems—if not

Drawing suggested by a Saturday Evening Post cover by R. Sargent

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for today, then for tomorrow. Sociologists, clergymen, and educators have been insisting for decades that ideas and attitudes can be "catching," but only in recent months have influential medical scientists begun to wonder together whether this sort of communicability may have been underrated in its impact on the general health and well-being of individuals.

The American Medical Association's first organized exploration into the field of the contagion of human thought processes took place last November, when the Council on Mental Health sponsored a conference of several dozen physicians prominent in government, education, and private practice. At the same time the Joint Commission on Mental Illness and Health, supported in part by the A. M. A., was in the midst of an exhaustive study of the epidemiology of mental and emotional sickness. That report, breaking scientific ground in a comparatively open field, will be published later this year.

The conference and the study evoked significant comment from organizational as well as clinical leaders in the profession. While Dr. Gunnar Gundersen, then President of the A. M. A., was calling for an understanding of the susceptibility and resistance of our population to mental and emotional illnesses, Dr. Jonas Salk was predicting that when enough is known of communicability in this field, "measures might be taken to immunize healthy individuals." (See Medicine at Work, THE JOURNAL, Jan. 31, 1959.)

What physician has failed to be impressed, and concerned, with evidences of induced insanity or effective brainwashing or abuses in hypnosis or increased "hidden persuasion"—all manifestations of attitude and idea transference? Even more ominous is the possibility that the "catchiness" of neuroses will trigger chain infections of anxiety from generation to generation.

The Cantonese Chinese

Dr. James Clark Moloney, a psychiatrist, notes that this country's first Cantonese Chinese settlers were stable and emotionally mature. But prolonged exposure to "American pressures" brought significant changes. "The newborn Chinese is inoculated with his mother's tension; an emotional disease is in the making," Dr. Moloney reports. "With each succeeding generation the Chinese becomes less mature, less flexible, and less stable, so that finally the Chinese examined by me and other physicians in northern California seem more disturbed than Caucasians examined under similar conditions."

Nor is the phenomenon peculiar to an ethnic group. Speaking of comparable impact in any family, Dr. Leo H. Bartemeier of Baltimore, who is Chairman of the A. M. A. Council on Mental Health, says, "Whatever untoward effects a husband may have on his wife are in turn experienced by their child. She may not be aware of transferring any antagonistic feelings, but the infant may sense them through her tenseness, her lack of customary gentleness, or the awkwardness of her movements."

Listen to how Dr. Jack R. Ewalt, as director of the Joint Commission on Mental Illness and Health, sharpens that point: "[People] in the United States show behavior resulting from a combination of biological and sociological forces. Various persons and social institutions impinge upon the individual, some with an organizing or health-promoting function and some with a disorganizing or illness-producing function. The effect of the impingement of these forces on a person will depend on the resilience he has developed through his inherited tissues and his life experiences up to this point in time."

These observations, seen in the light of Dr. Moloney's experience in California, suggest that many complex forces unite to produce neuroses among wide segments of the population. For are we not concerned here with the problem of biology as it relates to many fields? The individual person

Germs and Culture

Prominent in efforts to measure the "catchiness" of certain mental and emotional disorders is Dr. John Gordon, professor of epidemiology at Harvard University. The following are some of his comments at an A. M. A.-sponsored conference:

"One of the misconceptions of infectious disease is that communicability is a function of a germ. Well, most germs don't move. Something has to take them—a vector or a vehicle—and an idea or attitude can be 'airborne.' . . .

"You must have mental illnesses which come and go—you are physically sick one time and not another—you have a diarrhea but it disappears. There are variations. . . .

"In my war experience I saw an epidemic of psychoneurosis on the beachhead at Normandy that went up and down as sharply as any influenza epidemic, and I saw that same thing repeated in the Battle of the Bulge. . . .

"It is a dynamic process, this frequency of mental disorder in a community. Due to deterioration in certain cultural aspects of our society, too many of us as individuals grow up being emotionally immature and therefore unable to withstand the stresses within ourselves, the stresses society gives to us, and especially the stresses that come from war or some disaster or [other] extraordinary event. . . .

"There is an epidemiology of health as well as an epidemiology of disease, and I think there is communicability involved in it. I suppose the pediatrician has done as much as anyone in developing an epidemiology of health, and the dentist comes pretty close. True enough, an epidemiology of health is just being taken on in medical thought. I don't think we have developed it anywhere near the point that its potential significance warrants, but I do think it is the epidemiology of the future."

is growing and changing. All that he is is not determined by his genes alone but also by a number of events that occur after birth.

These events take place at home and at school, in social settings and in his work environment. They happen wherever and whenever ideas and attitudes —valid as well as perverted—are absorbed for eventual rebound from brain to brain. Here are cases documented in the scientific literature:

—A Denver clothier, preparing to file his income tax, remarks facetiously, "I think I can beat the government out of some money." His young son, unable to discriminate between sarcasm and strict fact, stores the remark away as license to do wrong elsewhere.

—The persistent scolding of an anxiety-ridden mother in New York City evokes anxiety reactions in her young daughter. Their family physician finds that the girl is also exposed to the stresses of her emotionally disturbed public school teacher. The doctor, probing further, learns that the results of an ambitious medical study to gauge the effect of New York teacher attitudes on pupil behavior have been officially kept secret.

—An official of the National Safety Council, defending young drivers, tells an audience in Winnetka, Ill., "How can you blame a teenager for being confused when his old man's whole attitude on safety is to talk like a saint and drive like the devil?"

—The divorce of an Oklahoma City couple reputed to have been happily married brings a flurry of appointments at a physician's office. He reports, "Not generally realized is the effect a marriage breakdown will have on the lives of friends of the split couple. The insecurities of their own married lives, small though these may be, are sometimes magnified to an alarming degree. These otherwise adjusted couples become infected for awhile with despair and sadness."

—An epidemic of hysteria breaks out in a British women's hospital ward after an unmarried patient tells of a nightmare in which she gave birth to a baby in view of her entire family. For weeks afterward, patients speak of similar fantasies, and the only topics of conversation are sex, birth, and death. Two physicians describe the effect of the original nightmare with subtle understatement, "This might be regarded as an infectious event."

—A well-known actress plays the role of a schizophrenic in a Hollywood motion picture, and months later she still is trying to stop playing the role in a hospital for the mentally ill. This might be an example of "autocommunicability."

These cases illuminate seeds of communicability. The seeds are implanted in person-to-person contact, fertilized in the family to grow throughout the community, blown and sown from nation to nation. Contact might communicate a fleeting thought or involve the transference of broad patterns of thinking. "The more completely we identify with others," says psychiatrist William C. Menninger, "the more completely do we absorb their attitudes and values. They become part of us."

Under certain conditions such contagion in its most harmful form may induce insanity. Two French clinicians described *folie à deux* in 1877 as a "mental disorder in which symptoms, particularly paranoid delusions, from which one of two persons is suffering are communicated to and accepted by the other."

In a nonpsychotic sense, there is a modern

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For More Creativity in Science

How can scientific creativity be increased in the United States?

Scientists (including medical) who have made important discoveries in their fields joined with leaders from industry, government, and education this summer at Harvard University to evaluate "Scientific Creativity in an Organizational Setting." Since most scientific work goes on within large organizations, such as university, industrial, and government laboratories, the conference July 20-22 spotlighted the influence of this environment on creativity among individual persons and in groups.

(The idea of increasing and inducing scientific creativity through the cross-fertilization of ideas in a multidisciplinary setting was explored in a Medicine at Work report on serendipity on Dec. 21, 1957.)

parallel to the behavioral infection of a period in the 14th century when thousands of young people danced uncontrollably in the streets of Europe. The parallel, according to Dr. Joost A. M. Meerlo, New York psychotherapist, is rock 'n' roll, "which belongs in a nearly unexplored chapter of psychology —that of mental contagion." Sociologists also cite the goldfish-swallowing craze of the 1930's, the panty raids that spread each spring from campus to campus, and the countless other community fads which bespeak a human readiness to go with the crowd.

"Psychopathic" Nations

Even the concept of "psychopathic" nations' communicating a kind of mental illness between themselves is noted in medicine. Dr. Jerome D. Frank, associate professor of psychiatry at the Johns Hopkins Medical School, suggests that the United States and Russia "breed dislike" (as do paranoia patients) when the two governments become mutually suspicious and force each other to behave in a manner that confirms and heightens the other's fears. Another American psychiatrist, entitling his paper, "Mental Infections," writes, "The Russian psychology of alternating cold wars with hot peace propaganda may be based on the recognized fact that continual fear merely results in a continuous defense reaction, whereas alternating waves of terror, with interludes of hope and quiet between, interrupt the formation of a defense mechanism, leaving persons with vague, uncompensated fears of the next impending catastrophe, in a highly suggestible state receptive to the attacker's next demands." Those statements were made in 1958. Perhaps the exchange visits of President Eisenhower and Soviet Premier Khrushchev, scheduled for the weeks ahead, will alter the pattern.

Of course, to assume that a mentally healthy person will automatically "catch" another person's sickness of mind by mere association, is as absurd as the assumption that tuberculosis is caused only by the tubercle bacillus. It is not; there is a multiplicity of other disease factors. There is strong evidence, in fact, that contact with the mentally ill can be therapeutic.

Listen to Dr. Karl Menninger, brother psychiatrist of "Dr. Will," as he describes this phenomenon in Topeka, Kan., site of the Menninger Clinic. "Many of our citizens have discovered that it is not only the sick people who are benefited when a town gets interested in psychiatric illness. There is something about working with sick minds that makes ordinary people sensitive to suffering, more tolerant, more human—even to each other. They discover that love cures people, the ones who receive love and the ones who give it also."

A woman psychiatrist who practices in New York City, Dr. Marion Kenworthy, reinforces that observation. "If we do a good job of taking care of emotionally sick people and help them learn how to make themselves well, they are the best kind of proponents for good mental health in their own children."

But, if mental and emotional illness is contagious in some situations and therapeutic in others, how may people build a pattern of resistance that will make them stronger instead of weaker in the presence of those disorders? Finding an answer should be an ultimate goal of physicians, educators, sociologists, psychologists, anthropologists, and others who now are amassing knowledge to construct a theory of the epidemiology of mental and emotional influences.

One guidepost for them might well be the degree of awareness with which individuals approach interpersonal relations—their ability to discriminate between fact and fiction, between truths and half-truths. We seem to be so effective in communicating our material goals as compared to our spiritual goals. Is it because a spiritual goal, not easily grasped, demands effort in the lazy land of man's mind—effort that can easily take a short cut, say, through the ethereal back alley of rumor?

One rumor, circulated last year, had it that eastern Poland was about to be annexed to Russia. It resulted in a wave of despondency, drunkenness, and refusal to work. Last February, in the same area, another rumor alleged that the United States was seeking Poles as colonists in the new state of Alaska. Also unfounded, that story sent thousands of peasants and workers scraping together railroad fare to Warsaw, where they jammed the United States embassy to file applications which many of them had bought, although the papers are available at no cost.

What roles do propaganda and profiteering play in these pseudo-facts which are rumors? There may

be an answer in the concept that a carrier of disease need not be a chemical or a physical or a biological thing. It can be a bullet or it can be an idea. It can be persecution. It can be any number of things, including the big lie. As Nazi Germany's chief propagandist, Paul Goebbels, once admitted, "By means of shrewd lies unremittingly repeated it is possible to make persons believe that Heaven is Hell."

Communicability and Communications

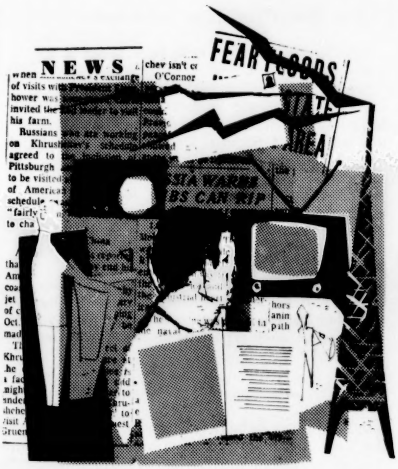
Ever since Hitler expanded that technique to infect masses of population with a kind of paranoia, the words "communicability" and "communications" have become more and more intertwined. So much so, in fact, that it is almost impossible to find a spot on the globe where the spoken or written word is not being invoked to influence thought and action.

The words spring out of newspapers at street corners and out of "talking" rockets hurtling through space. They speak from pocket-sized radios on commuter trains and from pulpits everywhere. In the name of enlightenment and in the interest of politics, in the furtherance of education and in the pursuit of the dollar, the words are fired broadside and blowgunned one by one in a power struggle for men's minds. Too often, even when we poor listeners sneer at the catchwords clouded in semantic fog, we submit unconsciously to their pear shape or become fascinated by their expressive power.

Even a physician may unknowingly cause incalculable harm to his patient through misuse or abuse or no use of a word or a phrase. "In many instances," says Dr. Walter Baer, a member of the A. M. A. Council on Mental Health, "our language structure is such that in our communications with each other abnormal reactions are set up. For instance, the term 'heart disease,' without qualification of the type or severity, may induce anxiety reactions in a patient to whom the term signifies thrombosis and early death. Is this not an innocent communicability of disease from doctor to patient through improper use of communications?"

Health Is "Infectious," Too

The answer is yes, but it works the other way, too. "There are doctors who can make a patient feel better simply by walking into the room," Dr. Henry A. Davidson told the Medical Society of New Jersey last year. "This magic seems to be totally unrelated to the doctor's education, or even to his intelligence. Certainly the major factor in this additional skill comes under the heading of the healer's personality. The patient's will to live, or the patient's giving up in defeat, may make the difference between life and death. If this is so, then the



doctor's own cheerfulness becomes a life-giving factor in the doctor-patient relationship."

Dr. Davidson touches on a point of paramount significance. For already there is solid evidence that, like "an infectious smile," mental health can be as communicable as mental illness. A child who is taught not to steal accepts this as a general idea, and it develops into a feeling—not just an understanding—that creates an iron-clad "prejudice" against stealing.

In Phoenix, Ariz., not long ago a team of qualified psychiatrists was ready to concede defeat in efforts to screen out undesirables from applicants to the police force. Despite the most careful use of "personality studies," some new officers still were not turning out well. A miscast rookie casually shot and killed a rat running across a barroom floor and then laughed—and half the customers shivered in fear of their own lives.

So the psychiatrists took a new tack. They suspended their screening operation and instead assigned a limited number of newcomers at random to the guidance of men who had proved themselves in the police organization. Last autumn one of those doctors reported at a medical meeting, "We had to relearn the hard way that a man who has done a good job on the force, who has exercised good judgment—his healthy attitude as a police officer seems to infect the new recruit. The same recruit, put on with an inadequate police officer, seems to acquire the other habits. The communicability of healthy attitudes has certainly shown itself to us."

It has also shown itself to Dr. Bartemeier, the Baltimore psychiatrist. He tells about a group of

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insurance company employees who had worked morosely in adjoining cubbyholes for years. One day they were assembled, introduced to one another and encouraged to chat. "These people developed a camaraderie, a sense of identification with the company and their fellow workers," reports Dr. Bartemeier.

Certainly, better policemen and better employee morale are commendable goals, but the truly exciting promise in cultivating mental resiliency lies in a realm not yet seen. As physicians join in the exploration of mental contagion they may uncover benefits more vital than a cancer cure or a solution to the riddle of heart disease. For, if the thoroughness of laboratory method produces principles for reducing the incidence of mental and emotional sickness, then the door will be open for a grand-scale effort in preventive medicine. Through that door more of the mentally ill could then pass as recovered, and better total health might come into view for even "normal" people beset with the growing anxieties of modern civilization—anxieties which hit the body as well as the mind.

Drs. Lawrence E. Hinkle Jr. and Harold G. Wolff, of the Cornell University Medical College, not long ago sounded that challenge of the future when they announced, "The evidence from 3,000 individuals studied shows that the reaction of a man to his life situation plays a role of significance in at least one-third of all episodes of physical disease, regardless of their nature or location, their cause or their severity. Ultimately, medicine will have to take account of this in the treatment of illness. It is probable that an increasing proportion of therapeutic effort will have to be directed toward the patient's relation to his environment if we wish to make any significant improvement in his health. . . . Even cancers of fibrous tissues might be responsive to a profound [sociological] disturbance . . . that caused hormonal changes in the body."

A Tool and a Benchmark

There are other challenges, too, the foremost of which are a tool and a benchmark. The true measure of good mental health in the United States does not lie in inverse proportion to the population of our mental institutions. Nor does it lie in such generalized statements as "Everybody is neurotic." The woeful lack of prevalence or incidence figures on mental and emotional illness today stands as the single greatest hurdle in scientifically determining its degree of communicability. That is why Dr. John Gordon, professor of epidemiology at Harvard, insists that "psychiatrists who are trained in epidemiological methods represent one of the critical things we need."

Only when there are mechanisms for measuring mental health and illness can communicability be weighed, analyzed, and eventually controlled for the benefit of mankind. Then, perhaps, these questions can be answered more in certainty than in conjecture:

—How much more infectious are attitudes passed on by a leader than those spread by a follower?

—What kind of a link exists between the general level of emotional maturity in individual members of a culture and the decline of that culture? How are we able to protect ourselves from bigotry, hate, panic, and smugness—contagious diseases of the mind which have shattered more societies than all the viruses known to civilization? A lazy France fell before hard-working Germany, hard-living desert riders largely destroyed the voluptuous Byzantine Empire, uncultured barbarians took luxury-loving, hate-mongering Rome—and now "peasant" Russians have achieved unparalleled scientific know-how in competition with "advaneed" Western nations.

—How accurately can epidemics of neurotic reactions be predicted on the basis of concurrent world or community crisis? For example, the radio drama about invaders from Mars was broadcast as Hitler was threatening to launch a European *putsch*. The Salem witch trials were held during a period of smallpox outbreaks, Indian raids, and widespread alarm that freeholding of land might be abolished. The dancing mania in the 14th century erupted immediately after a devastating plague in Europe. And World War II was raging in 1944 when the community of Mattoon, Ill., literally rose up in arms after a "mad anesthetist" who existed only in rumor.

The questions are demanding and urgent and personal, because they touch us all. Dr. Will Menninger describes their broad implications this way:

"We live in a turbulent world, a 'crazy' world, with many evidences of man's hostility to man—thoughtlessness and inconsiderateness and double talking and suspicion and distorted value systems, and greed and prejudice and hate. We see this turbulence 'acted out' in so many ways—in labor-management disputes, in increasing [juvenile] delinquency, in the high rate of divorce, in alcoholism, in drug addiction, in mental illness, and in humanity's greatest failure, war. All of these are evidences of mental ill health, maladjustment, our inability to get along with one another. But it is our world; it is what we are making it; and its course depends on the responsibility that you and I assume for it."

Members of the A. M. A. Council on Mental Health are Drs. Walter H. Baer of Peoria, Ill.; Hamilton Ford of Galveston, Texas; Lauren H. Smith of Philadelphia; George E. Gardner of Boston; Francis M. Forster of Madison, Wis.; Norman Q. Brill of Los Angeles; Hugh T. Carmichael of Chicago; M. Ralph Kaufman of New York City; and Leo H. Bartemeier of Baltimore, Chairman. Dr. Richard J. Plunkett of Chicago is staff secretary.

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EPIDEMIOLOGY OF THE FUTURE

WHERE does medicine go when skills developed over the centuries are able at last to subdue today's top killers, cancer and circulatory disorders? Will major efforts then be concentrated on fathoming such puzzlers as the common cold, the crippling diseases which have their origin in muscular and neurological disorder, and the gremlins on wheels and in homes and at work which "cause" accidents?

These and other enemies of good health are likely to remain long after the separate riddles of cancer and heart disease begin unraveling. Above them all, however, looms a larger and more ominous scourge—disorders of the mind. Although mental illness is as old as mankind, only recently have significant numbers of physicians been fired with the view that it is a disease, involving a susceptibility factor as well as a resistance potential, which is amenable to control through a broad program of preventive medicine.

But there is a major stumbling block to such a program. Mental illness is the only major public health problem that is not adequately reported. Clearly, the first need is for charting prevalence and incidence, for encouraging the pursuit of psychiatric epidemiology, and for delineating the pattern of this ailment, so that the sick may know the shape of a cure and the well avoid the shadow which infects. That mental illness may be as communicable as measles is suggested in a Medicine at Work report on page 186. But equally significant, as the report shows, is the promise that mental health is just as "contagious." It is this two-way phenomenon of communicability that holds hope of a new era in medicine, an era in which the profession may be able to call on its own ever-growing dynamics of practice to prevent family and community turmoil, to strike effectively at greed and prejudice and hate, and even, perhaps, to fashion the foundation for world peace.

Producing an epidemiology of mental illness and health, therefore, might well be medicine's prime goal for tomorrow. Advance soundings along this line were made less than a year ago in Chicago at a conference sponsored by the A. M. A. Council on Mental Health. And later this year the first detailed report dealing with the epidemiology of mental and emotional illness will be published as part of the findings of the Joint Commission on Mental Illness and Health, of which the A. M. A. has been a major sponsor.

One medical educator describes it as "the epidemiology of the future." If that is the goal, then its closest pursuit will consist in the cooperative effort of physicians, psychologists, sociologists, teachers, anthropologists, clergymen, and others dedicated to tasks relating to the human personality. They are the ones best able to show that the biggest gap in man's understanding of man is the chasm through which attitudes and ideas—both good and bad—impinge and reimpinge on myriads of minds.

INTERPROFESSIONAL RELATIONS

"The medical profession can well afford to take the lead in seeking mutually dignified relations with the sciences and health professions to which it is allied."[1] Leake has drawn attention to the opportunities afforded by cooperation with fields related to medicine such as dentistry, pharmacy, veterinary medicine, nursing, and public health.

The American Medical Association has had cordial relations with these groups on the national level, cooperating in various ways. The program at the Annual Meeting of the American Medical Association often includes contributions from representatives of such related organizations and contact is maintained throughout the year in one way or another. These contacts could be extended by inviting members of such organizations to attend national, state, and county medical meetings and participate to a greater extent. As Leake points out, however, this must be done with tact, sincere good will, and wisdom.

A further possibility includes interprofessional meetings at local levels, promoting cordial and mutually respectful understanding between the various members of the health team. These include all those who participate scientifically, technically, or humanistically in the health effort. All have a common purpose, which is a worthy one. The importance of promoting good morale in the team will serve not only the physician but his patient as well. It is a worthy undertaking and should be supported by the medical profession.

1. Leake, C. D.: Interprofessional Relations, Pharos of Alpha Omega Alpha 22:177-179 (July) 1959.

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COUNCIL ON NATIONAL DEFENSE

In the following pages, the Council on National Defense presents the papers given at its seventh annual National Medical Civil Defense Conference on June 6, 1959, in Atlantic City. This program consisted of a one-day version of the Army Medical Service one-week course on the management of mass casualties. The A. M. A. House of Delegates, by resolution, acknowledged the program as an outstanding contribution to medical education for disaster and expressed its desire that such disaster medical information be widely disseminated to members of the medical profession.

FRANK W. BARTON, *Secretary.*

INTRODUCTORY REMARKS

Harold C. Lueth, M.D., Evanston, Ill.

The American Medical Association has long been interested in disaster medical care, and we are happy today to present the seventh annual National Medical Civil Defense Conference. There is a growing concern among physicians that adequate steps be taken to assure good medical care under conditions of disaster. Emergency medical services, including those for traumatic injuries, have been actively studied by a growing number of men within the last few years.

The Army Medical Service has made significant advances in many fields of emergency medical service. With the experience of past wars, the results of research in the management of traumatic wounds, and the clinical observations of critically studied patients in Army hospitals, there have evolved some fresh surgical approaches to old complex problems. With the development of larger weapons and greater casualty-producing devices and agents, there have been significant, though perhaps less dramatic, medical advances that appear to hold promise of reducing death and disability on the battlefield.

Old ideas have been enlarged to newer, wider concepts of action. For example, first aid is not merely what is done until the medical officer or medical aid man arrives but now includes the immediate application of these lifesaving and sustaining measures that each soldier must carry out for himself—for his buddy—until medical aid arrives. Sorting is not the casual screening of patients by a very junior medical officer at the admission office of the hospital but an operative policy accepted by all medical officers at all times in the handling of casualties during mass-casualty-care operations.

New dimensions in the treatment of burns, shock, hemorrhage, and traumatic injuries will make possible the saving of more lives and limbs with fewer medically trained personnel than was formerly believed possible. With adequate training and management, medical and other troops will be able to face biological, chemical, and radiologic attack, including radioactive fall-out, with fortitude equal to that with which they have encountered other hazards in the past. Emotional and psychological aspects of disaster, even when seen in large numbers of persons, should not be considered as hopeless problems but should be realistically handled, since they are amenable to well-defined patterns of action.

We are honored to have the surgeon general of the Army, Major Gen. Leonard D. Heaton, with us, and we wish to thank him for making this scientific program, presented entirely by Army Medical Service officers, available to us. A treat is in store, for in one day there will be a summary of the Army's one-week course on mass-casualty care, which represents the thoughts, controlled experiments, critical tests, and shrewd observations of many resourceful and devoted medical officers over the past 10 years. Important advances have been made by each of the medical services of the armed forces and the federal government; however, it was largely the deep interest and active efforts of former Surgeon General Silas B. Hays that led the Army Medical Service to pioneer this work.

Speaking for the Committee on Disaster Medical Care and the Council on National Defense of the American Medical Association, I want to thank each speaker for his participation in the program. Much of the material presented will have some applicability in daily practice, more of it will be useful in planning and operating a civilian disaster medical service, and all of it will be essential in mass-casualty care. The Council is honored and pleased to sponsor today's program, which will be presented by the U. S. Army Medical Service.

636 Church St.

Chairman, Committee on Disaster Medical Care, and Member, Council on National Defense, American Medical Association.

WELCOME ADDRESS

Louis M. Orr, M.D., Orlando, Fla.

It is an honor to represent the American Medical Association in welcoming you and extending best wishes for a successful conference. Today's conference is the seventh national medical civil defense program which has been sponsored by the Association through its Council on National Defense. In fact, the Council has been actively engaged in the field of medical preparedness for disaster nearly 14 years. Many of us in the medical profession have become increasingly concerned with our nonmilitary defense posture. We individually and collectively have a tremendous role and responsibility in civil defense affairs.

The Association recently completed a special study and report dealing with medical civil defense problems for the Office of Civil and Defense Mobilization (OCDM). Under the terms of the contract the Association was requested to develop criteria for the provision of medical care for the surviving population—casualty and noncasualty—in the event of an enemy attack on this nation. The report was approved by the A. M. A. Board of Trustees and was submitted to the OCDM on April 15.

To impress on each of you the challenging responsibilities we share in civil defense, I will quote one paragraph from this report.

> The role of the medical profession is to prepare its members to cope effectively with the results of a mass attack on the United States and to assist actively in preparing the nation to withstand such an attack. In the event of a mass attack on this country, the role of the medical profession is to provide to the nation the highest quality and best organized curative and preventive medical services possible in order that maximum numbers of physically and mentally fit survivors, imbued with high morale and a courageous spirit, are and will become available to assume their share of responsibility in the ensuing national recovery effort and to participate in concurrent and subsequent combat operations.

I am sure you will agree that this is indeed a solemn task and a gigantic mission we face.

The one other thought I want to leave with you concerns the splendid work of the Army Medical Service and in particular their excellent courses dealing with the military medical preparedness for the care of mass casualties in case of war. The House of Delegates of the Association, meeting in Minneapolis in December, 1958, recognized this achievement with the following resolution:

> WHEREAS, The American Medical Association, based on reports from its Council on National Defense, wishes to recognize and commend the excellent medical training program of the Medical Service of the United States Army; and
>
> WHEREAS, Shortly after World War II the United States Army Medical Service initiated courses relating to medical matters incident to atomic and nuclear warfare; and
>
> WHEREAS, To date nearly fifty courses have been conducted from which over 6,000 students have been graduated; therefore be it
>
> *Resolved*, That the United States Army Medical Service and the Surgeon General merit approbation for an outstanding achievement in disaster medical education; and be it further
>
> *Resolved*, That this commendation be transmitted to the Surgeon General, United States Army, and the Secretary, Department of the Army.

The program to follow will be presented by Army medical officers and military personnel who have devoted a great deal of time and effort to the problems of nuclear warfare and the management and care of the mass casualties that would result. The Army Medical Service has developed a positive approach of instruction in its course "Management of Mass Casualties." The Association is grateful to Major Gen. Silas B. Hays and his medical staff for presenting today's program to acquaint civilian physicians and allied health personnel with the education and training that is being conducted by the Army Medical Service.

I believe that the motto of the Army Infantry School at Fort Benning is "Follow Me." Each of us would do well to adopt that attitude and take advantage of the accomplishments of the Army Medical Service by following its programs in the field of medical preparedness for disaster and civil defense and to use these programs to set up patterns of training for civilian physicians. These courses offer civilian physicians a rare opportunity. I sincerely hope that you will give this serious consideration.

1300 Kuhl Ave.

President-elect, American Medical Association.

ARMY MEDICAL SERVICE COURSE ON MANAGEMENT OF MASS CASUALTIES

Major Gen. Leonard D. Heaton (MC), U. S. Army

As surgeon general I am delighted to respond to the request of the Council on National Defense of the American Medical Association for the Army Medical Service to present the scientific program for your section this year. The speakers and presentations which you will hear today are representative of the two courses on mass casualties which are given at the Army Medical Service School at Fort Sam Houston, Texas, and at Walter Reed Army Medical Center in Washington. You will recognize each of the speakers as an expert in his field, and we believe their data to be the finest in the world on the subject of the management of multiple casualties in order to obtain the maximum survival rate with the facilities at hand.

Surgeon General, Department of the Army, Washington, D. C.

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The management of multiple casualties requires, first of all, a plan—a plan based on experience and knowledge. I recall my own experience at Pearl Harbor when we were suddenly faced with many hundreds of casualties on a Sunday morning. Our facilities and personnel performed admirably but, in some cases, inadequately. I was impressed by the magnitude of the problem of thermal injury. I am pleased to note that the Army Medical Service instituted the surgical research unit at Halloran General Hospital in August, 1945. One of their first assigned tasks was the management of thermal burns. The fruition of the research will be presented by Colonel Vogel, the present commanding officer of that unit, which is now at Brooke Army Hospital.

The work at Brooke has not dealt exclusively with burns. Colonel Ziperman will give you data on our present concepts of sorting and establishing priorities for the care of multiple casualties with many types of trauma.

The remainder of our program will deal with other aspects of the problem—all the result of Army Medical Service research and investigation. Our concepts of the management of nuclear weapons casualties have been investigated at a full-scale nuclear weapon detonation. This study gave us a field test and additional data on the effects of radiation alone or radiation in combination with other trauma. This will be reported on by Colonel Moncrief.

Historically the Army Medical Service has pioneered in many aspects of medicine: yellow fever at the Panama Canal, malaria in World War II, and hemorrhagic fever in Korea are but a few. In consonance with our leadership we have given courses on mass casualties first at Walter Reed in 1946 and then at Brooke. In these courses we have transmitted our concepts to some 8,000 students in the medical profession over the past decade. Some 4,000 have been given a lesser indoctrination on the same subject. This latter group encompasses many of our allies in the North Atlantic Treaty Organization countries.

This course will deal primarily with nuclear weapons casualties. We will also discuss chemical and biological warfare casualties. In spite of the emphasis on nuclear weapons, we believe that these concepts will apply in any disaster in which there are multiple casualties, in war or peace. Certainly hurricanes and tornadoes or floods tax our medical facilities far beyond their present capabilities. I commend to you this day's symposium on the Army Medical Service doctrine on the subject of the management of multiple casualties.

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CASUALTY ESTIMATION

Major Jack C. Fitzpatrick (MC), U. S. Army

Nuclear and thermonuclear strikes on heavily populated areas would cause a tremendous number of casualties requiring immediate medical attention. A rapid, simple, and accurate method of casualty estimation would be necessary on a local and a national basis. This estimate should give the survivors some idea of the types and numbers of casualties and of the personnel, supply, transportation, bed, and other requirements resulting from the disaster.

There are many systems for estimating casualties, some involving the use of templates on maps and others using ring or "cooky-cutter" systems and varying amounts of mathematical manipulation. Very detailed methods involve hours of calculations and the use of semilogarithmic graphs, fractional powers, and in some instances classified information. Detailed analyses by current methods have been associated with a high incidence of error even in experienced, highly competent hands.

A rapid, practical, more accurate system for estimation of the medical, logistic, and tactical implications of nuclear weapon strikes on personnel will be presented. This system was conceived under the direction of Col. Roy D. Maxwell, M. S. C., by Howard Laitin, Ph.D. (then a first lieutenant in the Medical Service Corps, U. S. Army [Res.]), and other personnel in the office of the assistant for nuclear warfare instruction and nuclear casualty studies, Army Medical Service School, Brooke Army Medical Center. Dr. Laitin, a systems analyst and statistician, is now working for a civilian organization. His outstanding ability, vision, and sincere interest in the welfare of the United States are manifested in this and in his other projects, which required long hours of work and research.

Assistant Chief, Department of Medicine, Brooke Army Hospital, Brooke Army Medical Center, Fort Sam Houston, Texas.

Information Provided

This is a system for nuclear warfare, and some of the terminology is peculiar to the military. However, it has definite civilian application. This system rapidly estimates (1) damage to friendly and enemy personnel and equipment, (2) resulting medical service problems, and (3) other data of tactical and logistic value. As compared with our present methods, this system is faster, more accurate, more detailed, and simpler, and the personnel requirement is both quantitatively and qualitatively less. Not only are fewer people required but background in advanced mathematics and intensive training in the method are not necessary. This system is consistent with the concepts of modern warfare.

With respect to groups of casualties, the method provides information (for specific poststrike times) concerning numbers and types of injured, clinical condition, prognosis, tactical effectiveness, time of evacuation, treatment requirements, and single or combined injuries. It does this on a percentage basis designed to take into consideration the normal biological variation in response to injury. Temporal relationships are included, and information on specific locations can be obtained. It is not implied that this system or the digital computer inherent in it is capable of satisfactorily replacing the clinical judgment of a physician with respect to evaluating the clinical condition and treatment requirements of individual patients. Physicians' judgment and decisions concerning clinical behavior of groups of patients are incorporated into the template and the computer in advance.

With respect to medical service requirements, information concerning personnel, supply, equipment, transportation, and hospitalization necessities is provided from the combat zone to installations in the continental United States. Data of value to arms and services other than the medical service are also supplied. Should multiple strikes occur in close succession, the method does not break down, since these data can be simultaneously considered by the automatic data-processing system.

It is stressed that at this particular time the system is the important consideration. Medical data concerning hour-by-hour human response to specific injury are supplied as a best estimate from currently available information. This will serve as a framework for incorporation of better data as they become available, and future revision is anticipated.

Three Systems

Three systems will be considered here: (1) the manual system, involving the use of a special template on a map, (2) a semiautomatic system which incorporates the manual system but in addition utilizes a digital computer which is now available at field army level, and (3) a fully automatic, or ultimate, system which is envisioned in the future. All of these systems may be used for research or by military and civilian personnel in wartime.

The use of a template was indicated in the description of the manual and semiautomatic systems. This template is useful in rapidly and accurately estimating casualties and obtaining data on physical effects after the detonation of nuclear weapons. The template stores data and offers the advantages of greater speed, accuracy, simplicity, and detail when compared with previous templates. It consists of a transparent plastic base to provide a clear view of any map on which the template is placed. This base has an open window which provides space for rotation of pie sections and for access to the map or overlay surface where information may be recorded and distance rings drawn with the pie section designed for that purpose. Any number of pie sections may be incorporated into the template, containing any desired data from classified or unclassified sources.

Various pie sections contain information on the radiation, thermal, and blast levels as a function of distance from ground zero. Concentric rings on the top of the template and on the pie sections are 200 m. apart. In addition, the map-scale, yield, and height of burst of the weapon are also recorded on top of the template, as is the source of the data on enclosed pie sections. This is necessary in order to quickly select the proper template for use in a particular situation.

Manual.—The use of this template in the manual system in a theoretical military situation may be summarized as follows:

1. A nuclear detonation occurs over a battle group.

2. Information as to the approximate yield of the weapon, height of burst of the weapon, and ground zero coordinates is relayed by radio, telephone, or other means back to division headquarters.

3. The analyst in division headquarters receiving this information also obtains data concerning troop concentration and disposition in the strike area from the operations map.

4. With this information, the analyst can select the proper template, apply it to the map situation, rotate the proper pie sections into position, and readily obtain and record data on physical effects, such as blast, thermal, and radiation levels, and can obtain medical and tactical information as well.

5. The time required for this entire process is relatively short; the procedure is much simpler and there is much less chance for error than with our previous systems for obtaining the same information. This manual system can be used in research, in combat at the division level or higher, and could readily be applied to civilian situations.

Semiautomatic.—The semiautomatic system involves the use of most of the manual system up through the application of the template to the map. However, in the semiautomatic system only data on physical effects are taken from the template, such as radiation dosages, calories of heat per square centimeter, and pounds per square inch of blast overpressure. These data are then relayed by radio or telephone from division headquarters back to field army, where a mobile digital computer is stationed. The data are transferred to IBM cards by sense marking, and such cards are fed into the computer, which has previously been programed for medical, logistic, and tactical implications of data on physical effects. With this method, pertinent typewritten information can be obtained

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from the computer within minutes after receipt of figures from the analyst using the template in division headquarters or another area.

A chart of the human response to various types of injury is the basis for programing the automatic data-processing machine. All other information, such as that for determining requirements for personnel, beds, and transportation, is dependent on the human response to trauma. The preparation of a chart (in a form suitable for automatic data processing) considering mechanical, thermal, and radiation injuries of different severities and in various combinations is a major undertaking, and little objective information on human combined injury is available on which to base such a chart. The present chart contains information concerning the effects of various short-term whole-body doses of irradiation on the human. The dose has not been accurately known in most instances of short-term whole-body irradiation of healthy humans. It is stressed that the human irradiation data contained in this chart, although considered to be the best available at present, are not submitted as final accurate objective material. This is only an initial attempt to establish a framework for use in this system. Better human dose-response data can be incorporated as experience grows. This chart is designed to provide medical and tactical information on groups of persons subjected to various doses of short-term whole-body irradiation on an hour-to-hour basis for times up to 21 days after the injury. An attempt has been made to take into consideration the normal biological variation in response to a particular injury. It is not presumed that any physician can accurately predict the hour-to-hour behavior of irradiated humans at this time. The data are arranged in the manner described to satisfy the automatic data-processing requirement.

Fully Automatic.—The proposed fully automatic, or ultimate, system evolves from those already discussed. It would incorporate an automatic nuclear detection device which would instantly relay information as to the height of burst, yield, and location of ground zero to the digital computer. Information contained in a template and in the combined injury chart, along with the logistic, tactical, and other implications, would have been programed into this computer. The template step is thus eliminated from the system. In a few minutes, after one or more nuclear strikes in an area where personnel are located, printed information would be available from the computer as to the medical, tactical, and logistic problems resulting from the disaster. It is conceivable that this information in an overseas combat situation would appear simultaneously locally and in appropriate installations as far back as those in the continental United States.

Two films were included in this presentation: a seven-minute one showing the composition of the template and its use as part of the manual system on a military map situation involving a nuclear detonation and a three-minute one showing a chart on human response to radiation injury.

The source of information on the template is "Effects of Nuclear Weapons," Pamphlet 39-3, Department of the Army, which is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at a cost of $2.

SIMULATION OF MILITARY CASUALTIES

Lieut. Col. Vincent I. Hack (MSC), U. S. Army

The development of powerful new destructive weapons by our potential enemies demands realistic training for our soldiers and citizenry in the various aspects of military and civilian defense preparedness programs. To develop these programs, it has been noted that practical realistic demonstrations in the simulation of casualties must be an adjunct to comprehensive instruction on recognition, care, and treatment of casualties. The use of films, charts, graphs, and other visual aids has been highly successful, but no single medium has added more realistically to the efficient training of troops and civilians than simulations of casualties through the effective use of theatrical make-up, modeling clay, and *moulages*.

Experience has shown that proficiency and accuracy in the skill of simulating casualties can be attained only through repetitious training by skilled technicians under the supervision of professional personnel. The Army Medical Service School at Brooke Army Medical Center has pioneered, in the United States, the use of instructional material to interpret properly the medical aspects of diverse types of casualties through the medium of inexpensive theatrical make-up.

For our present-day Army personnel, most of whom have not experienced the horrors of large-scale disasters or seen the devastating aftermath of an atomic or hydrogen bomb explosion, training must be realistic in order to produce definitive results in the event of a catastrophe. Realistic simulated casualties are tremendously important in providing the experience that is so urgently needed to evaluate injuries; i. e., recognition, care, and treatment of injuries, applying the essentials of medical aid under emergency or disaster conditions. Simulated casualties, if portrayed properly, can be a potent stimulus to the minds of the students to a degree that will long be remembered.

Chief, Training Aids Branch, Army Medical Service School, Brooke Army Medical Center, Fort Sam Houston, Texas.

Casualty simulations have proved to be of immense educational value for clinical demonstrations, not only to the medical profession but to nonprofessional members of the medical services of the armed forces as well. This program has been developed to such a high degree of effectiveness that it opens a field of education destined to have far-reaching possibilities.

The object of producing simulated casualties is to permit the soldier to practice on subjects simulating as clearly as possible actual injuries which may be sustained in situations indicated by adequate staging. It follows, therefore, that three factors must be considered. In order of importance these are acting, make-up, and staging. Of these, acting is of utmost importance, since, without adequate and accurate acting, little purpose is served in presenting skillfully made-up characters.

Casualty Simulation Kit

Item	Amount	*Cost*, $
Sticks, grease paint		
Stein's no. 5L (ivory yellow)	1	0.75
Stein's no. 11 (sallow old man)	1	0.75
Stein's no. 18 (carmine)	1	0.75
Stein's no. 21 (vermilion)	1	0.75
Stein's no. 22 (white)	1	0.75
Stein's no. 25 (black)	1	0.75
Sticks, lining color		
Stein's no. 5 (dark gray)	1	0.40
Stein's no. 7 (dark brown)	1	0.40
Stein's no. 10 (dark blue)	1	0.40
Stein's no. 16 (yellow)	1	0.40
Stein's no. 19 (green)	1	0.40
Face powder (natural)	1 box	0.75
Plasticine (modeling clay)		
Flesh color	1 lb.	0.35
White	1 lb.	0.35
Foam rubber, 2 by 2 by ½ in.	1	0.01
Spatula (palette knife)	1	1.10
Scissors (sharp point)	1	1.06
Petrolatum, white	4 oz.	0.05
Cold cream	8 oz.	0.20
Bottles, 8 oz., for liquid blood	1	
Jars, 2 oz., for coagulated blood	2	
Powdered carbon	2 oz.	0.75
Brushes, water color, sizes no. 2 and 8	2	0.70
Duco household cement, tubes	2	0.50
Dropper, medicine	2	0.03
Glycerine	2 oz.	0.08
Cleansing tissue	400 single sheets	0.20

In training "casualties," the advice and criticism of a physician or nurse should always be obtained. Sincerity in portrayal is the keynote. It is advisable that several persons be trained in the make-up technique at the same time, since no two persons will react in the same way to the same situation and one person alone will not be able to complete the make-up. This also allows for comparison and mutual criticism, and, if one person is unavailable because of sickness or duty, demonstrations will not be held up. The necessary basic equipment for the make-up kit is listed in the table.

Application of Basic Shock Make-up

Take a small quantity of cold cream or petrolatum and smooth gently over the face with the fingertips. Do not rub too hard or the skin will become red, defeating attempts to make up realistically. Cover the whole area exposed (i. e., face, ears, and neck, front and back) to below the line of clothes. This insures a smooth finish to the work and also enables the grease paint to be removed easily. Wipe off surplus grease until only a thin trace remains. Apply the basic-color grease paint by drawing the stick over definite areas of the neck and face. Be careful to avoid a heavy line where the hairy surfaces end (i. e., forehead, eyebrows, and eyelashes). Gray and blue shading around the eyes, lips, nose, and ears is added gradually, with a fingertip, not the liner. Over the grease paint put a light coating of "natural" powder to remove shine. Apply very sparingly and evenly to offset the need for removal of excess, which would damage the texture of the make-up. Do not be too heavy with finished make-up. Do not overdo blueness. Do not let green grease-paint touch the hair or beard. Do not use grease paint on sore or affected areas of the skin. Do not forget that the hands, if visible, must show signs of paleness or blueness in accordance with the face. Practice often and patiently and have your own materials (for obvious reasons).

Simulation of Tissues

Simulated tissues should never look false. Careful attention must be paid to colors, bulk, and surface texture with regard to hair, veins, scars, etc. The surface of the false tissues must appear the same as the surrounding natural tissue. Practicable false tissue can be made up with flesh-colored Plasticine. From this basic shade other shades can be made by covering with grease paint to match the casualty's skin.

Application of False Tissue

A simple way of starting to apply false tissue is to select a nonhairy surface such as the ball of the thumb. Take a piece of Plasticine about the size of a garden pea. Roll it out in a cylinder about 1 in. long with tapering ends. With a molding tool or knife (preferably pliable but blunt) fasten down on one end and then the remainder. Try not to extend the area to be made up, but keep the false area confined. Next smooth out the sides, leaving a slight ridge along the center of the cylinder. When the whole of the tissue has been fixed at the edges, the center ridge is smoothed out until practically no elevation can be seen that is not in accordance with the natural contour of the limb or part. A good rule for the selection of the amount of false tissue needed is to take what is thought to be necessary and then halve it. In this way you can insure that the false tissue area is not going to be unnaturally bulky. When the tissue has been smoothed out as

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much as possible and an even outside edge has been blended into the surrounding skin tissue, smooth over the whole area a thin film of petrolatum until the tissue is quite smooth. Lightly apply grease paint of an appropriate color until the false tissue is completely disguised. This routine should be practiced until perfection is reached.

Once this has been done the next stage is to make wounds which will be in character with the types liable to be caused by various instruments, i. e., knife, jagged tin, barbed wire, bullet entry and exit wounds, and larger wounds consistent with objects such as shell fragments. A good means of producing these is by using the pointed end of a nail file or modeling tool. The cut is made to the required size, taking care not to penetrate the skin. A little dark blood paste is inserted into the base of the cut to emphasize the depth of the wound. Next apply a shading of light blood paste to the inner edges and lips of the wound to give the appearance of freshly damaged flesh. Be careful not to go outside the edges of the wounds with the blood paste. All that remains now is the application of the liquid blood. Care must be taken to show the right amount of bleeding.

Burns

Burns are easily simulated to look realistic. By using red, the superficial burns can be produced. The materials are carmine grease stick, "coagulated blood," and "liquid blood." Even shading and blending of the materials will show the areas most severely burned, and the only precaution is that care be taken not to extend the areas affected to an unnatural size. Blisters of petrolatum, sealed with tissue paper and collodion, or Duco household cement will give the effect of deep burns. Ashes and black grease paint will add to the effect.

Simple Recipes for Blood Paste and Liquid Blood

Dark blood paste may be made by melting together, slowly, two parts petrolatum, one part vermilion, and a small amount of light brown and blue grease paint. Light blood paste is made by melting together, slowly, two parts petrolatum and one part vermilion. Thicker blood for insertion into wounds is made with 1 pt. of liquid starch, 10 cc. of red vegetable coloring (concentrate), 3 cc. of yellow vegetable coloring (concentrate), and 1 drop of blue vegetable coloring (concentrate). The amount of coloring depends on the brand of coloring used. Vary amounts to match a piece of gauze dipped in real blood to one dipped in the facsimile blood. Thin blood for coloring dressings is made by diluting the above formula with water.

Comment

By the practice and use of the foregoing simple techniques, adequately simulated casualties are easily and quickly produced. It is essential that the casualty be rehearsed and briefed in acting the specific injury. This requires study and patience. The casualty should have a good knowledge of first-aid procedures and appreciate fully how the sight of severe injuries shocks the uninitiated observer.

FIRST-AID SURVIVAL CARE

Lieut. Col. Joseph D. Goldstein (MC), U. S. Army

What is first aid? In theory, it tries to save life and limb and minimize discomfort and deformity. In practice it far too often has meant covering the injury and hastily disposing of the injured person to a medical facility. One must realistically appraise the foreseeable conditions which may prevail in a mass-casualty situation incident to nuclear weapons warfare. Such appraisal reveals certain features. First aid will be given for the most part by relatively inexperienced people immediately adjacent to the place where the injury took place. It will be given with materials available at that time and place. This premise must be kept clearly in mind if we are to achieve the greatest yield from this type of care.

One must also face the disturbing probability of disrupted communications, the like of which we have not experienced in the past. This implies that early care must be provided locally and over widely dispersed and isolated areas. This plainly means that everyone must know what to do to counter the threats first to life and second to limb when and where the need arises. It also means that this care must be of a sustaining nature. In short, first aid must attempt to insure the survival of the casualty. With survival as the goal, it seems appropriate to call this care "survival care."

Chief, Department of Atomic Casualties Studies, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D. C.

Objectives and How to Achieve Them

To achieve this goal, one must first announce some sound aims and principles of resuscitative care in consonance with the tenets of good medicine and surgery. To start, one must determine the objectives for optimal professional emergency resuscitative care and then tailor these objectives to fit the foreseeable circumstances. These goals primarily are (1) control of bleeding, (2) maintenance of respiration, (3) maintenance or reestab-

lishment of fluid and electrolyte balance, (4) correction of jeopardizing mechanical defects, (5) prevention or minimization of further tissue damage, (6) suppression of infection, and (7) relief of anxiety and pain.[1]

Whereas a discourse on these matters in technical terms may be appreciated by those trained medically, the intended user, "the man on the street," will gain more if the material is couched in plain terms. The language used must clearly tell him what to do, when and how, and "just enough" why to do it. It is recognized that the nuances of medicine may be lost in this process of simplification. Yet this loss is acceptable if it favors communication of essential information to the user; the payoff is performance. To this end, one might restate the aforementioned objectives as follows: 1. Keep the parts in place. 2. Keep the parts working. 3. Keep the parts clean. 4. Consider the whole patient and not just the parts. 5. Avoid introducing further injury.

Now one can proceed to formulate methods of achieving the stated objectives. Some general concepts are discussed below.

Examination of the Casualty.—Do first things first. First things are directed against the early killers such as hemorrhage and respiratory impairment.

Control of Hemorrhage.—Without getting overly involved as to whether bleeding is arterial, venous, or capillary, it is enough to emphasize that bleeding as such, regardless of type, must be stopped or controlled. The initial procedure should be the proper application of a pressure bandage. This will suffice in most cases of external bleeding if given half a chance to do so. In the event that the pressure bandage proves inadequate, a tourniquet should be applied. The tourniquet materials used should be those most likely to be available when and where needed, and specialized items should not be emphasized. The application must be proper. It must control the bleeding and not increase it. Once applied, the tourniquet should be left in place until adequate medical care becomes available. Accepting this principle, one cannot escape the possibility that with mass casualties the time lag between tourniquet application and medical care may impose the penalty of amputation. In plain words, the need for the tourniquet should be lifesaving. The price may be a limb. Pressure points and positioning of bleeding parts may also be taught if time permits.

Maintenance of Breathing.—Everyone readily appreciates the fact that when one does not breathe one dies, and dies quickly. Breathing should be maintained by assuring a patent airway and a working breathing mechanism. A patent upper airway may be achieved by clearing the mouth and throat of obstruction. Obstruction may be caused by a relaxed tongue, blood, mucus, or vomitus. The breathing mechanism may be kept working by correcting a defect such as a sucking wound of the chest with a simple but adequate dressing. The popular notion that tracheotomy by anyone having a knife and a subject is the preferred method for treating respiratory obstruction must be scotched. Tracheotomy is a surgical procedure that requires skill. More important, judgment is required to decide when it should be done, and knowledge of proper postoperative care is mandatory. Such judgment and knowledge are not envisaged for persons with this level of training. In cases where respiration must be reestablished, an accepted type of artificial respiration suitable to the type of casualty must be provided quickly.

Emergency Splinting.—The axiom of splinting the limbs of persons with known or suspected fractures where they lie must be impressed on everyone. No casualty with a fracture or extensive laceration should be moved without prior immobilization of the limb unless a greater immediate threat to life exists by not moving the casualty first. Everyone can understand that uncontrolled movement of jagged-edged bones may tear blood vessels and nerves, increase pain, and produce shock. Immobilization of the affected part will prevent this additional tissue damage and also favor reasonable anatomic alignment. The fractured member should be made to resemble its uninjured counterpart if feasible. It must be emphasized that immobilization is not the same as traction. Training materials used for immobilization should be improvised from commonly available items. If necessary, immobilization may be done by tying one body member to another. Patient comfort and future function should be the guidance for manipulating and positioning the fracture.

Wound Dressing.—Simple dressings should be used for covering most wounds, with some adjustments for dressing injuries to the jaw, hand, and chest. The main point is to determine whether there is a need for a dressing. Ideally one should strive to have surgically clean dressings; however, compromises can be made along these lines if the situation so dictates and the need for the dressing is present.

Handling of Patients.—Handling includes much more than transportation. The crux of the matter lies in the fact that a casualty is a perishable commodity. One must appreciate that caring for an injured person embraces much more than just caring for an injury. The reassuring word, proved worthy in the past, may probably be more important in the future. This is particularly true because we may be dealing with a population sensitized to the injurious effects of ionizing radiations. It must be emphasized repeatedly to everyone that the presence of nausea and vomiting may or may

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not indicate the presence of ionizing radiation injury. Nausea and vomiting most certainly may not reflect the severity of ionizing radiation injury during the early postexposure period, especially in the presence of other trauma. The possibility of psychogenic vomiting from pure mental distress or suggestion cannot be overlooked.

Common sense procedures such as giving fluids by mouth, providing warmth, proper positioning, and careful movement of the casualties may well make the difference between living and dying. The need for timely movement to avoid additional threats from local radioactivity and fire are self-evident. Hasty movement must never be confused with rapid but careful transport of casualties.

Benefits of Instruction Program

Whether attempting to instruct all persons in the treatment of shock is of value is moot. The suggestion presumes that these relatively inexperienced persons will be capable of recognizing shock at a time when they can do something about it. Even if every lay person could recognize shock, he in all probability would still be limited by his knowledge, experience, and equipment. In fact, he might significantly prevent shock by the timely and appropriate application of the aforementioned methods. Prevention is unquestionably far better than attempting to treat the condition after it has occurred. It seems more profitable to direct efforts toward instruction in tangible procedures which people can expect they will be able to carry out rather than to encumber them with complex theories on the mechanisms of shock.

A simplified and standardized program of instruction in survival care should yield, among other obvious benefits, two major ones. First, everyone will become factually aware of certain types of injuries that may occur. Increased individual confidence should substantially decrease frustration and fear of the unknown. This confidence derives from placing at everyone's disposal information that allows him to cope with the situation with reasonable assurance on his part. Second, the medical profession actually "buys time." Aside from the magnitude of the situation, time must be bought because conditions may deny early availability to the casualty of the needed medical care. This denial may stem from many factors, ranging from rubble to radioactivity. At the same time, the wounded simply may not be able to wait and survive until the urgently needed professional medical care can be provided.

Repeated appraisals of assumed mass-disaster situations only confirm the foreseeable inordinately long time lag between injury and medical care. To bridge this, we must extend our resources through a tailored type of care given by available personnel and equipment if it is to be provided at all in a timely and effective manner. To extend this care by acceptable and orderly means, the medical profession must view everyone as its temporary agent. If this be so, it appears reasonable that such agents must be told what to do and how to do it. Finally, to insure proficiency and confidence in any prescribed program for good "survival care," the medical profession can complete its contribution by periodic monitoring of the program.

Reference

1. Hughes, C. W., and Hartgering, J. B.: Management of Mass Casualties, Publication 573, Walter Reed Army Institute of Research, Walter Reed Army Medical Center, Washington, D. C., Sept., 1955.

EMERGENCY MEDICAL PACKET FOR ONE HUNDRED PERSONNEL

Col. Theodore M. Carow (MC), U. S. Army

My presentation concerns what we in the military medical services have termed the medical matériel program for nuclear casualties. I will briefly discuss the concepts of the program, with special emphasis on phase 1 and additional comments on phase 2.

Older concepts of general war held that medical support in both manpower and resources would increase gradually and concurrently in relation to the total military manpower buildup, that the United States base would remain intact, and that medical care would be provided by or under the direct personal supervision of a military physician. The advent of thermonuclear weapons has caused a radical change. Wide-scale destruction and damage to our resources here and in our oversea commands and the imposition of a military mass-casualty load which can occur with dramatic suddenness are distinct possibilities. These conditions were the basis of the recommendations of the Assistant Secretary of Defense (Health and Medical) to the Secretary of Defense in 1956 for the establishment of the emergency medical care program.

The program objectives provide for the development and acquisition of "in being" military medical resources and capabilities for the essential medical support to the armed forces. The medical resources are required for the emergency-disaster phase after a thermonuclear attack and for the postattack

Chief, Supply Division, Office of the Surgeon General, Department of the Army, Washington, D. C.

rehabilitation period until procurement sources can be revitalized to meet essential minimum requirements.

TABLE 1.—*Medical Supply Set for Emergency Treatment of 100 Personnel*

Item	Unit	Quantity
Master Pack (2 boxes: 1 containing dextran; 2nd containing all remaining items)		
Dextran injection, 6%, 500 cc	Pkg.	12
Morphine injection, U. S. P., 16 mg. (¼ grain), 1.5 cc. (Syrette)	Each	100
Soap, surgical, 4 oz	Cake	6
Chloramphenicol capsules, U. S. P., 0.25 Gm.	Bottle of 100	10
Bandage, gauze, roller, 4 in. by 10 yd.	Pkg. of 12	2
Catheter, urethral, rubber, Robinson no. 18 French	Each	6
Forceps, hemostatic, curved, Kelly, 5½ in.	Each	12
Holder, suture needle, Hegar-Mayo, 7 in.	Each	2
Blade, surgical knife, detachable, no. 10	Pkg. of 6	1
Handle, surgical knife, detachable blade, no. 3	Each	2
Needle, suture, catgut, Mayo, ½ circle, taper point, size 4	Pkg. of 6	1
Scissors, bandage, angular, Lister, 7¼ in.	Each	3
Scissors, general surgical, curved, Mayo, 6¾ in.	Each	2
Suture, nonabsorbable, surgical, silk, braided, size 0, 18-in. length	Pkg. of 3	50
Tourniquet, nonpneumatic, camouflaged, 1½ by 42 in.	Each	6
Cannula, tracheotomy, Jackson, size 5	Each	6
Pencil, skin marking	Each	6
Fracture Pack (1 box)		
Bandage, gauze, roller, 4 in. by 10 yd.	Pkg. of 12	4
Wadding, cotton, surgical, sheet, 5 in. by 6 yd.	Pkg. of 12	6
Scissors, bandage, angular, Lister, 7¼ in.	Each	1
Splint, wire, ladder, 3½ by 31 in.	Each	36
Pins, safety, curved, orthopedic, large	Card of 12	3
Burn Pack (2 identical boxes)		
Lubricant, surgical, 4 oz	Each	60
Sodium chloride–sodium bicarbonate mixture, 4.5 Gm.	Pkg. of 2	96
Bandage, gauze, roller, 4 in. by 10 yd.	Pkg. of 12	2
Gauze, absorbent, 36 in. by 5 yd.	Pkg.	18
Scissors, bandage, angular, Lister, 7¼ in.	Each	1
Pins, safety, curved, orthopedic, large	Card of 12	6
Wound Pack (4 identical boxes)		
Bandage, gauze, roller, 4 in. by 10 yd.	Pkg. of 12	3
Compress and bandage, field, 18 by 22 in. compress	Each	8
Dressing, first aid, field, 4 by 7 in.	Each	48
Pad, gauze, surgical, 4 by 4 in.	Pkg. of 200	3
Scissors, bandage, angular, Lister 7¼ in.	Each	1
Pins, safety, curved, orthopedic, large	Card of 12	3

To accomplish these tasks the Secretary of Defense established a committee consisting of representatives of the surgeons general of the Army, Navy, and Air Force and the Assistant Secretary of Defense (Health and Medical). This committee evaluated the problems and developed a four-phase program. Briefly, these may be described as follows:

Phase 1 contemplates emergency self-aid or "buddy"-type aid. The treatment is directed toward saving life and minimizing injuries and is outside of medical channels. In most cases, this care will be given without medical supervision.

Phase 2 contemplates austere extension of phase 1 emergency-type treatment, with initial definitive care in medical channels by nonprofessional medical personnel under professional supervision.

Phase 3 contemplates extension of phase 2 patient care to include outpatient and preventive medicine practiced under severe shortages of matériel, often in improvised facilities and with limited professional and technical staffs.

Phase 4 contemplates the revitalization of all military medical resources in terms of such manpower, facilities, matériel, and services as can be obtained from the national economy.

Phase 1 and 2 objectives are designed to meet the emergency disaster phase after a nuclear attack, while phase 3 and 4 objectives are directed toward the postattack rehabilitation period.

Development of Supplies

The first practical approach appeared to be in the matériel area. The committee selected an austere list of essential medical survival items for phases 1 and 2 after considering the over-all medical problem, determining the type of casualty most likely to occur, and judging the type of emergency treatment most applicable under austere conditions. General Ewell of Civil War fame said: "The road to glory is not traveled with much baggage." In the development of the supplies for phases 1 and 2, the "road to glory" has been approached through severe austerity.

In developing the list of items for phase 1, the basic assumptions included that, first, little or no help or aid would be received from outside the damaged area in the immediate postattack period; second, the majority of the immediate treatment must consist of self-aid or buddy aid; third, the capability of the average lay person, even with minimum training, to render survival-type care is limited; fourth, any selection of items must consider their transportability, shelf-life expectancy, and general simplicity; and fifth, some provision must be made for more extensive care in the event professionally directed supervision is available. A list of medical supplies consisting of only 26 items (table 1), which professional opinion considered absolutely essential, was developed for phase 1. The quantity of medical matériel is considered sufficient for buddy-aid treatment of casualties occurring in 100 personnel over a period of 72 hours.

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TABLE 2.—*Emergency Medical Treatment Unit for 1,000 Nuclear Warfare Casualties*

Item	Unit	Quantity
Burns		
Dextran injection, 6%, 500 cc	Pkg.	100
Dextrose injection, U. S. P., 5%, 1,000 cc.	Box of 6	75
Sodium chloride injection, U. S. P., 1,000 cc.	Box of 6	75
Albumin, normal human serum, U. S. P., 100 cc	Can	100
Bandage, stockinette, hand burn	Pkg. of 10	20
Bandage, muslin, 5 in. by 5 yd	Pkg. of 12	120
Bandage, muslin, 37 by 37 by 52 in.	Each	50
Wadding, cotton, surgical, sheet, 5 in. by 6 yd	Pkg. of 12	20
Intravenous injection set, disposable type, field	Set	900
Bandage, cotton, plaster-of-paris impregnated, 5 by 30 in.	Box of 50	12
Splint, leg, Thomas, half-ring, aluminum	Each	50
Strap, webbing, splint, 36 in., with buckle	Each	50
Pins, safety, curved, orthopedic, large	Card of 12	100
Wounds		
Tube, rubber, ¼ in. inside diameter, 1/16 in. wall	Ft.	200
Bandage, gauze, roller, 4 in. by 10 yd.	Pkg. of 12	60
Adhesive plaster, surgical, 12 in. by 10 yd	Roll	12
Pad, gauze, surgical, 4 by 4 in.	Pkg. of 200	80
Pad, gauze, surgical, 4 by 8 in.	Pkg. of 100	40
Catheter, urethral, rubber, mushroom tip, Pezzer, no. 20 French	Each	36
Forceps, tissue, tweezers type, straight, 5½ in.	Each	12
Needle, hypodermic, 17 gauge, 3 in.	Box of 12	12
Needle, suture, skin, ⅜ circle, cutting edge, 2½ in.	Pkg. of 6	2
Stylet, catheter, malleable, straight	Each	6
Suture, nonabsorbable, surgical, silk, braided, size 2	Pkg. of 12	12
Syringe, Luer, 30 cc	Each	36
Tube, duodenal, surgical, Levin, no. 14 French	Each	72
Cannula, tracheotomy, Jackson, size 5	Each	12
Tube, rubber, Penrose, drainage, ¾ in.	Each	60
Suture, absorbable, surgical, boilable, mild treatment, size 0, single armed, ½ circle	Pkg. of 12	6
Tube, connecting, surgical apparatus, straight, glass	Pkg. of 12	5
Instruments		
Knife, Craftsman's, 5 in.	Each	6
Airway, pharyngeal, Guedel, rubber, small, adult	Each	24
Catheter, urethral, rubber, Robinson, no. 16 French	Each	30
Forceps, hemostatic, curved, Kelly, 5½ in.	Each	24
Forceps, hemostatic, straight, Kelly, 5½ in.	Each	24
Forceps, hemostatic, straight, Rochester-Ochsner, 7¼ in.	Each	12
Holder, suture needle, Hegar-Mayo, 7 in.	Each	6
Inhaler, anesthesia, Yankauer	Each	4
Blade, surgical knife, detachable, no. 10	Pkg. of 6	6
Handle, surgical knife, detachable blade, no. 3	Each	12
Needle, hypodermic, 20 gauge, 1½ in.	Box of 12	24
Needle, hypodermic, spinal puncture, 18 gauge, 3½ in.	Each	12
Needle, suture, catgut, Mayo, ½ circle, taper point, size 4	Pkg. of 6	12
Saw, amputating, Satterlee, 8 in. blade	Each	1
Scissors, bandage, angular, Lister, 7¼ in.	Each	20
Scissors, general surgical, curved, Mayo, 6¾ in.	Each	12
Suture, nonabsorbable, surgical, silk, braided, size 0	Pkg. of 12	36
Syringe, Luer, 10 cc	Each	48
Tourniquet, nonpneumatic, camouflaged	Each	6
Retractor set, general operating, flexible, set of 2	Set	2
Drape, surgical, plastic, sterile, 36 by 42 in.	Pkg. of 6	16
Litter, folding, rigid pole, aluminum pole	Each	100
Blanket, bed, wool, olive green	Each	100
Apron, laboratory, plastic	Each	50
Cold Sterilization		
Soap, surgical, 4 oz	Cake	50
Benzethonium chloride tablets, 0.25 Gm.	Bottle of 80	40
Brush, scrub	Each	24
Acetylsalicylic acid, acetophenetidin, and caffeine tablets, N. F.	Bottle of 1,000	8
Aminophylline injection, U. S. P., 25 mg. per cc., 10 cc. ampul	Box of 25	2
Codeine sulfate tablets, N. F., 32 mg. (½ grain)	Bottle of 100	25
Ephedrine sulfate injection, U. S. P., 25 mg. (⅜ grain), 1 cc.	Box of 12	10
Morphine injection, U. S. P., 16 mg. (¼ grain), 1.5 cc. (Syrette)	Each	1,000
Thiopental sodium for injection, U. S. P., 0.5 Gm. ampul	Box of 25	2
Phenobarbital tablets, U. S. P., 32 mg., (½ grain)	Bottle of 100	50
Procaine hydrochloride, sterile, U. S. P., 100 mg. ampul	Box of 10	30
Ether, U. S. P., ¼ lb.	Can	96
Eye and nose drops, ½ oz.	Pkg.	12
Chloramphenicol capsules, U. S. P., 0.25 Gm.	Bottle of 100	50
Procaine penicillin G, U. S. P., 300,000 units	Bottle	4,000
Tetanus toxoid, U. S. P., 7.5 cc.	Bottle	135
Streptomycin sulfate, U. S. P., 1 Gm.	Bottle	500
Water for injection, U. S. P., 5 cc.	Box of 25	90
Lidocaine hydrochloride injection, N. F., 0.5%, 50 cc.	Bottle	10
Water-purification tablets, iodine, individual	Bottle of 50	2,000
Water purification and testing kit, Type 1	Kit	60

In developing the list of items for phase 2 (table 2), consideration was given to the assumption that initial definitive care would be given in medical channels with a minimum of professional supervision; that packaging would not be a prime consideration; and that the quantities must be adequate

for the austere care of large numbers of casualties. With these considerations, a listing of 75 medical items was developed with quantities sufficient to treat 1,000 casualties for a period of approximately 20 days.

Packaging

Subsequent to the development of items for phase 1, a project was initiated to develop a suitable container and for uniform packaging and marking. From this study, a unit-load package was developed which provides a high degree of protection and security for the items yet permits ease of identification and access to the contents. All items are packed into nine functional units in V 3C fiberboard cartons. There are two master or general supply packs, there is one fracture pack, and there are two identical burn packs and four identical wound packs. These nine cartons with appropriate identification markings are overpacked in a sturdy, corrugated, triple-wall outer carton. Sealing and marking of the outer carton provides immediate identification of the phase 1 emergency medical treatment unit and affords moderate security to the contents. This carton can be opened readily for access to the functional packs, and the nine individual cartons can be easily removed. Since individual functional packs vary in weight from only 27 to 40 lb. and the cube from 1 to 3 ft., they can be individually carried by one man as required. The over-all weight is 320 lb. and the cubic measurement is 28 cu. ft. The width permits passage through normal doorways.

For phase 2, it was considered sufficient for the selected items to be packaged in their original containers as normally purchased under military procurement specifications. The weight of these supplies is approxiately 10,000 lb., with a cube of 500 ft. There are approximately 150 boxes, with average weight of 40 to 75 lb. This is within normal limits for one man to carry.

Requirements and Distribution

Requirements for the phase 1 unit have been computed by the military services on the assumption that any member of the armed forces could become a casualty, but it is impossible to predict their number and where they will occur. Accordingly, we base our needs for the phase 1 unit on the basis of 100% coverage. On the other hand, requirements for phase 2 have been based on our capability along with availability of physicians. It was assumed that, on the average, 3.4 physicians could treat and direct paramedical personnel to treat 1,000 typical nuclear-attack casualties for a sustained period. It is to be noted that casualty estimations were not used in either determination.

Distribution of the phase 1 unit at post, camp, and station, naval or air base, wherever located, will be on the basis of an activity's personnel strength. One phase 1 unit will be placed per 100 personnel on board, including dependents and civilian personnel in oversea areas. Dispersal within the activity will be made on the basis of normal personnel concentration, i. e., in headquarters, barracks, shops, etc. The only limitation on dispersal is to protect the container from freezing. It is hoped that someday the plasma expander dextran now packaged in bottles in the phase 1 master pack will be packaged in plastic bags to avoid breakage.

Surveillance and rotation of items in phase 1 appear to be minor problems, since the shelf-like expectancy of all items is a minimum of five years, and only one item, a broad-spectrum antibiotic, holds that life expectancy.

Phase 2 matériel on the other hand, although it may be dispersed from normal operating supplies, will be carried as an element of the total supply on hand at a hospital facility, thus providing a means for stock rotation and thereby lessening losses by deterioration.

Because of the critical character, intended use, and susceptibility to pilferage of phase 1 supplies, it is necessary to establish internal military control and supervision of this phase of the program. Responsibility for this action rests with the local military commander under service regulations.

The training aspects of the program are most essential, not only for the physician and paramedical personnel but also for the line officer, soldier, seaman, and airman. The three services are including in their training programs training in the essential elements of first aid, self-aid, buddy aid, and the use of the emergency medical treatment unit.

The only obstacle that can conceivably lie in the way of complete implementation of phases 1 and 2 of the medical matériel program for nuclear casualties is provision of funds. Currently funds have been made available for approximately 25% of the program. Assembly of the phase 1 and phase 2 emergency medical treatment units is now under way at military medical depots. It is anticipated that deliveries of the supplies to military installations will begin in July, 1959.

Addendum

Since the presentation of this article, an additional item has been added to the emergency medical treatment unit, phase 1 (table 1), increasing the list of supplies from 26 to 27 items. The additional item is "airway, pharyngeal, plastic, adult-child," used in mouth-to-mouth resuscitation. One airway is placed in each of the burn, wound, fracture, and master (less dextran) packs, for a total of eight.

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SORTING FOR DISASTER SURVIVAL

Lieut. Col. H. Haskell Ziperman (MC), U. S. Army

The casualty-producing capabilities of the atom bomb and the thermonuclear weapon present a problem which for sheer magnitude is totally new in the annals of mankind. For the first time a country at war may visit on its enemies thousands or millions of casualties simultaneously, thus creating a great disparity between numbers of wounded and numbers of professional personnel available to provide treatment.

The destruction produced by thermonuclear weapons will probably disrupt lines of communication, transportation, and electrical power for days, and perhaps weeks, and will compound the disproportion between numbers of casualties and medical capabilities. This will render more difficult the mobilization of medical personnel. In addition, in the event of a thermonuclear attack, it is felt that not one or two strategic targets will be chosen for destruction but that, instead, many throughout the country will be struck simultaneously. Such a situation will make it necessary that each industrial complex handle its own wounded and dead with facilities and personnel available in the immediate area. In the event of a ground burst, persistent radioactivity in the area of destruction may complicate and render hazardous all attempts at rescue or first aid. If we add to all of the above the fact that necessarily there will be a shortage of hospital beds and stockpiles of supplies, we have presented a problem which can be staggering in its magnitude.

The medical management of large numbers of sick or injured, whether they result from epidemic disease, combat, or disaster, involves the establishment of an organization that takes into consideration every essential of proper care. This organization is not one which can be set up on the spur of the moment but must instead be set up far enough in advance to permit it to be tried and tested to insure its proper functioning. One could thus guarantee an orderly process of medical management, so that wherever possible each patient would receive treatment in proportion to his degree of morbidity and disability and under no circumstances would the lives of the many be jeopardized by the medical needs of the one or of the few.

Director, Department of Military Medicine and Surgery, Army Medical Service School, Brooke Army Medical Center, Fort Sam Houston, Texas.

Presently assigned as Chief, Surgical Service, Letterman Army Hospital, San Francisco.

In order to function properly, this organization must be prepared to classify and categorize its patients on the basis of type and severity of wound or disease condition so that a minimal time loss in the institution of proper therapy and disposition of each case can be expected. Early classification permits visualization of over-all medical requirements for large groups of casualties and, on this basis, aids in the decision as to when, where, and what type of therapy should be instituted. Lack of early classification of the sick and wounded en masse leads to confusion, chaos, and increased mortality, for then each patient is individually treated without regard for the more urgent needs of others in the group or for the medical capabilities of the organization.

Sorting, or triage, is officially defined by the U. S. Army as the procedure by means of which the sick and wounded are classified according to type and urgency of condition presented, so that they can be properly routed to medical installations appropriately situated and equipped for their care. It is a procedure that had its inception in the care of those wounded in combat but that, with only minor modification of specific detail, may be equally as well applied to any organization having as its responsibility the care of large numbers of injuries occurring relatively simultaneously.

Sorting is, in fact, the key to the management of these patients, for it is only by its means that casualties may be categorized properly and separated so that there will be a minimal time lag between injury and the onset of therapy. In its application, sorting considers the necessity for overlooking no one and for doing the greatest good for the largest number of casualties. Both these goals are accomplished by taking into consideration the medical capabilities of the installations involved and the relative proportion between the number of professional personnel available for the institution of therapy and the total number of patients requiring treatment.

Necessary Decisions

Criteria for Return to Duty.—Sorting is directed toward making decisions with regard to, first, the establishment of criteria for the return of the injured to duty. In combat, this decision will vary with both the type of wound sustained and the specific tactical situation, so that under no circumstances will a casualty be returned to duty if his incapacitation might interfere with the conduct

of the battle. Conversely, no casualty will be unduly delayed in his return to duty, for delay would result in the need for a replacement, and it is uneconomical to replace a battle-tried veteran with an unseasoned soldier. It thus becomes necessary to hold and treat casualties for periods of time that vary according to type and severity of wound, for on return to duty these casualties must be assets rather than liabilities to their organization.

Essentially, a priority for return to duty is established by weighing clinical condition against tactical requirements. In a disaster, on the other hand, clinical condition must be weighed against manpower shortages. Thus, the size of the disaster and the availability of outside help for the institution of rescue and of first-aid and emergency medical treatment may determine what type of injured, and how many, must be released in order to aid in the care of the other victims. Early release of disaster victims may also be determined on the basis of available hospitalization facilities, so that overcrowding and consequent jeopardy to health may be minimized.

Priority for Treatment.—The second decision to be arrived at in sorting concerns the establishment of priority for treatment. Because the type and urgency of the therapy to be employed will vary with the severity of the wound, a priority must be established for the care of the various types of wounded. Treatment priorities are not only dependent on the urgency of therapy required but also vary with the stated function of a particular installation, for it is on this basis that specially trained medical personnel are assigned and supplies and equipment allocated. Thus, the treatment to be given must be within the medical capabilities of the particular installation. With an adequate number and type of assigned professional personnel, priorities for treatment may have to be varied by the type and availability of medical supplies and equipment.

Typically, a hospital with only a limited supply of blood on hand and with little likelihood of more becoming available in the near future will use that blood so as to aid in the recovery of the largest number of injured. On this basis, the critically wounded man who would require all of the only 10 units of blood available in order to aid in his possible recovery would drop in priority to a position below that of the five casualties whose recovery would be assured by the receipt of 2 units each. Conversely, where only 2 units of blood are on hand to treat the shock of 10 casualties, the best utilization of this item would entail using it in the resuscitation of no more than one or two of these casualties rather than wasting it by giving each only 1/5 unit.

Establishment of priority for treatment may also be varied by the number and caliber of physicians available for the institution of treatment. Thus, in a disaster zone in which all physicians have become disabled and the institution of therapy must be accomplished by ancillary medical personnel, such as dentists, veterinarians, and nurses, little would be accomplished by the establishment of priorities for surgical procedures of other than minor magnitude, for they would be beyond the capabilities of the available personnel. In such a situation, only priorities for resuscitation and emergency medical treatment would be instituted. These casualties would then be evacuated to other installations whose personnel are more capable of handling the complicated technical surgical procedures required. Where large supplies of medical matériel are immediately available, in an installation adequately staffed for the care of any casualty, the priority for surgical treatment would depend on the type and urgency of treatment required.

Need for Evacuation.—The third type of decision to be made is the casualty's need to be evacuated for further treatment and the timing of this move in relation to the program of therapy. Basically, requirements for evacuation are determined by the need to conform to the tactical situation, which limits the number of noncombat personnel and the matériel brought into a combat zone. This limitation is necessary to prevent excessive interference with the mobility and maneuvering of the tactical force and allows for only a few small, highly mobile medical installations in the area. The evacuation of casualties either to prevent their interfering with the conduct of the battle or in order to insure them more adequate treatment in the larger, less mobile, better-equipped installations farther to the rear is, therefore, necessary.

Obviously, evacuation should be performed only for those casualties whose physical deterioration will not be accelerated by it, and it should be carried out in such a manner that safeguards will be provided against such an eventuality. Thus, a system of priorities for evacuation is established in the determination of which physical condition is weighed against the rigors of travel and both are balanced against the available means for transportation.

Although in some instances the priority for evacuation is the same as the priority for treatment, frequently the necessity for early urgent therapy is of such a high degree that unwise early evacuation prior to treatment could result in death. For example, a casualty in severe shock as the

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result of uncontrolled bleeding from a laceration of the femoral artery is given a high priority for the control of his bleeding and the treatment of shock and no priority for evacuation. After necessary resuscitation has been performed, he then receives a high priority for evacuation so that vascular surgery may be performed early. Each surgeon, as he sorts to determine priority for evacuation, must assess the urgency and degree of essential medical care against the available means of evacuation and the supporting medical capabilities. He must avoid arbitrary sorting for evacuation by determining that there is a place to which casualties can be evacuated, that there are suitable means for evacuation, and that the patient is in a fit state for this evacuation.

Characteristics of Procedure

All sorting, since it requires a high degree of professional skill in making the requisite clinical judgments, should be performed by the most mature surgeon of a given installation. These decisions are based on clinical experience plus an expert knowledge not only of the particular tactical situation but also of the medical capabilities of all installations in the treatment chain. A realistic appraisal must be made regarding the likelihood of survival, the time required to perform the needed technical procedures, and the capabilities for medical care available at the time and place. Errors in judgment will lead to increases in morbidity and mortality through subjecting to surgery casualties who have not been adequately resuscitated, evacuating injured without regard to clinical condition or the rigors of movement, and attempting procedures beyond the capabilities of the installation.

Sorting is a continuous procedure that starts with initial medical care and terminates only with the final disposition of each patient. It must establish priorities at each installation in the treatment chain because the function, medical capabilities, and facilities of each are different, and due consideration, in the light of these factors, must be given to every casualty on his arrival in the installation. Moreover, the condition of the patient will change as a result of the institution of resuscitative treatment, necessitating resorting. Furthermore, a continuing influx of casualties may cause a change in the priority for treatment and evacuation of the injured already present. These changes produce the need not only for sorting at each installation but also for a revision of priorities at fairly frequent intervals in each.

In addition to all of the foregoing factors, or perhaps because of them, sorting is necessarily a flexible procedure, for the considerations influencing the required decisions will vary from day to day and from one situation to another. Typically, the surgeon who sorts by rote may fail to consider many factors important in making the proper decisions. For example, he might overlook the fact that a disparity between the number of wounded and the total number of personnel available for institution of therapy might require a larger number of early evacuations to less crowded installations. If he fails to consider the need to move his installation in keeping with the tide of battle, he may accept more casualties than he can treat in the time allotted prior to the move. If, in his sorting for evacuation, he fails to consider inclement weather as a deterrent to helicopter travel, he may bring about increased mortality by subjecting casualties to traumatic overland ambulance moves. The ever-changing tactical situation must be observed and sorting must remain flexible and subject to modification as needed.

As enunciated in the preceding paragraphs, sorting has as its objective the classification and separation of large numbers of sick and wounded so that priorities for treatment, evacuation, and return to duty may be more easily established. This system has evolved by trial and error through past wars until at the present time we pride ourselves on the fact that by its means no casualty is ever denied treatment. Treatment is usually commensurate with the severity of injury and the quality and number of facilities and personnel available; the time lag between wounding and the institution of therapy is reduced to a minimum; and, because of its efficiency, we accomplish the greatest good for the largest number.

We must remember, however, that this concept of the establishment of priorities was developed during conventional warfare and was based on an unfailing source of medical supplies and little or no disproportion between numbers of casualties and quantity and quality of medical personnel available for treatment. In practice, this system has resulted in priorities for treatment usually being established on the basis of wound severity, so that the most severely wounded enjoy the highest and the least severely wounded the lowest priority.

Priority System for Casualties of Nuclear Warfare

Prior planning for the care of mass casualties due to atomic disasters makes it evident that some modification of our priority system must be established in order to avoid disservice to the many in favor of the few because of limited treatment facilities, inadequate supplies, and lack of medical personnel. Such a modification provides for all injured to be divided into four groups, as follows:

1. Casualties Requiring Minimal Treatment.—The first group of casualties requiring minimal treatment includes those who may be returned to duty, who have (1) small lacerations or contusions, (2) simple fractures of small bones, (3) second-degree burns of less than 10% extent but not involving face or hands, or have received (4) short-term whole-body ionizing radiation dosage of 100 to 150 rem. The second group includes noneffective persons who need domiciliary care for (1) disabling minor fractures, (2) burns of face or hands which interfere with the person's ability to care for himself, (3) moderate neuropsychiatric disorders, or (4) short-term whole-body ionizing radiation dosage of 150 rem or less in the presence of early symptoms.

These casualties truly have no priority for treatment but in practice will receive their treatment early. Ordinarily, their wounds are of such a nature that the treatment they receive while being sorted is all the therapy that they require, and they can then be returned to duty or remanded to domiciliary care.

2. Casualties Requiring Immediate Care.—Included as casualties requiring immediate care are those with (*a*) hemorrhage from an easily accessible site, (*b*) rapidly correctible mechanical respiratory defects, (*c*) severe crushing wounds of extremities, (*d*) incomplete amputations, (*e*) severe lacerations involving open fractures of major bones, and (*f*) severe burns of the face and upper respiratory tract necessitating tracheotomy.

The casualties in group 2 will enjoy the highest priority for surgical treatment because a relatively short procedure will suffice to save life. More definitive surgery can then be delayed to a later date, accepting infection as the price of this delay.

3. Casualties Whose Surgical Treatment May Be Delayed.—Persons whose surgical treatment can be delayed without immediate jeopardy to life include those with (*a*) simple fracture of major bones, (*b*) moderate lacerations without extensive bleeding, (*c*) second-degree burns of 10% to 40% and third-degree burns of 10% to 30% (after body fluid levels have been stabilized), and (*d*) noncritical central-nervous-system injuries.

This group is composed of casualties for whom a delay in treatment will probably lead to infection but whose lives will not otherwise be jeopardized by delay. The amount of delay between wounding and surgery for this group depends on the total number of casualties with higher priorities who need treatment and the number of professional personnel available to institute surgical treatment.

4. Casualties Whose Therapy Will Be Expectant.—Expectant therapy will be used for those with (*a*) critical injuries of the central nervous system or respiratory system, (*b*) penetrating or perforating abdominal wounds, (*c*) multiple severe injuries critical in nature, (*d*) severe burns of large areas (40% or above), or (*e*) established lethal or supralethal doses of total body radiation.

"Expectant" as used in this category does not mean that we expect all of these casualties to die and that we would provide them with no treatment as we wait for them to die. The expectant treatment for group 4 casualties would not be one of masterful neglect but would, instead, consist of that resuscitation and emergency medical treatment which the available facilities, total supplies, and number of professional personnel permit. Theirs would, however, be the lowest priority for surgery because the operative procedures required are lengthy and technically complicated, so that an operation on one of these casualties would theoretically jeopardize the lives of several in other priority groups. The more rapidly casualties in other treatment categories are treated and moved, the sooner we can get to the injured in category 4 and the lower will be the mortality rate to be expected.

Summary

Sorting is the key to the management of large numbers of injured persons during conventional combat, for it is only through its utilization that modern principles and practices of therapy may be proportionately applied to the combat wounded. Provided the enumerated changes in priorities are established, it will also become the key to the care of the larger number of simultaneous casualties resulting from the use of nuclear weapons in warfare. In civilian disasters or epidemics, adherence to the principles of sorting, establishment of priorities, and, where applicable, the need for evacuation will aid in minimizing morbidity and mortality.

Sorting is the procedure by means of which the sick and wounded are classified according to type and urgency of condition presented, so that they can be properly routed to medical installations appropriately situated and equipped for their care. It is a continuous procedure throughout the treatment chain and is practiced in each installation by the most mature surgeon available. The effectiveness of sorting is enhanced by observation of variations in the tactical situation. Sorting is directed toward establishing criteria for return to duty and priorities for treatment and evacuation. With certain changes in priorities, sorting as practiced during conventional warfare may be applied as the key to the management of casualties caused by either natural or nuclear disasters.

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MANAGEMENT OF BURNS RESULTING FROM NUCLEAR DISASTER

Lieut. Col. Edward H. Vogel Jr. (MC), U. S. Army

The advent of nuclear weapons not only has introduced a means by which massively large explosive power may be attained but also has given the general public its baptism of fear of ionizing radiation—a fleeting, unseen, unfelt messenger of death. This new and poorly understood phenomenon has so capitivated the minds of the public, as well as of many students, that they have overlooked the fact that thermal and mechanical trauma will be of much greater importance in a nuclear explosion of any large magnitude and, furthermore, that there is some hope of medical care being given for these types of trauma, while there is not yet any specific practical therapy for ionizing radiation.

These statements are supported by data on the portions of the total explosive energy in nuclear explosions which are delivered as a blast (50%), initial ionizing radiation (5%), residual ionizing radiation (fall-out) (10%), and thermal radiation (35%).

This is only a part of the story, however. Table 1 compares airburst nuclear explosions of various yields as to their effects. For comparative purposes there are shown for each explosive yield the radius from ground zero and the square-mile area at which 300 rem (sublethal) will be produced; the radius and square-mile area at which 2.5 lb. per square inch (0.17 atmosphere) of overpressure (sufficient blast to give broken glass windowpane pieces a velocity of 180 ft. per second) will be produced; and the calories per square centimeter, the radius, and the square-mile area at which second-degree burns will be produced on the bare skin. From these

TABLE 1.—*Comparison of Radiation, Blast, and Thermal Capabilities of Various Yield Nuclear Explosions*

Weapon Yield	Radiation, 300 rem		Blast, 2.5 psi‖		Thermal, 2nd-Degree Burns	
					Calories per Sq. Cm./	
	Radius‡	Area§	Radius	Area	Radius	Area
20 MT*	2.5	19.6	16.0	804.0	7.5/32	3,216
10 MT	2.2	15.2	13.2	547.0	7.0/26	2,123
1 MT	1.6	8.0	6.0	113.0	6.2/9	254
100 KT†	1.1	3.8	2.8	24.0	5.3/3.5	38
20 KT	0.8	2.0	1.7	9.0	5.0/1.8	10.2
10 KT	0.7	1.5	1.3	5.3	4.7/1.3	5.3
1 KT	0.5	0.8	0.6	1.1	4.1/0.5	0.8

* MT, megaton.
† KT, kiloton.
‡ Radius given in miles.
§ Area given in square miles.
‖ psi, pounds per square inch.

data it can be seen that initial ionizing radiation at the 300-rem level increases in radius only by a factor of 5 between a 1-kiloton (KT) and a 20-megaton (MT) explosion, while blast, at a pressure of 2.5 lb. per square inch, increases by a factor of 27 and thermal radiation sufficiently intense to cause second-degree burns increases from a radius of 0.5 mile to 32 miles, or by a factor of 64. It is obvious, I believe, that burn injury is likely to cause the greatest number of casualties in any nuclear explosion which results in a disaster or mass-casualty situation.

TABLE 2.—*Percentile Distribution of Casualties, by Feet from Ground Zero**

Distance, Ft.	Secondary Injuries	Flash Burns	Flame Burns	Radiation Sickness
0-3,000	62	22	9	39
3,000-6,000	50	52	9	41
6,000-9,000	26	44	18	16

* As determined by the Atomic Bomb Casualty Commission at Hiroshima and Nagasaki.

This last statement is further corroborated by the statistics derived by the Atomic Bomb Casualty Commission in their studies of the nuclear explosions at Hiroshima and Nagasaki. Table 2 summarizes these data and indicates that 40 to 50% of casualties will have flash-type burns (primary burns due to thermal radiations from the explosion), while an additional 20% may have flame burns (from burning buildings); in other words, 60 to 65% of the injured survivors will have thermal injury.

In your town how many people will be injured survivors of a nuclear disaster? Ten thousand, 50 thousand, 100 thousand, or more? Whatever the figure, about 60% will have burn injuries. Those who have treated a burned patient know that 10 burned patients admitted to any of our large hospitals will almost completely disrupt all its functions. What will be done with 6,000 such patients, or 30,000, or 60,000, particularly when there are only limited or no hospital facilities, medical supplies, physicians, nurses, etc.?

Indoctrination

Again, we are faced with that old but ominous word "disparity." Because of the disparities in personnel, supplies, and equipment, it is obvious that we must make many compromises with the ideal care of burns. Furthermore, we must have planned and trained in advance for such an eventuality. The more people we have trained and indoctrinated prior to a disaster, the better prepared we will be.

The first factor of indoctrination must be the acceptance of a reasonable doctrine of medical care in disaster. Because of the disparities which I have mentioned, some general policies of medical care must be established. I believe that these policies must include:

1. Self-care to be utilized for everyone able to do so.

Commanding Officer, Surgical Research Unit, Brooke Army Medical Center, Fort Sam Houston, Texas.

2. Buddy care to be utilized for those ambulatory patients who, because of injuries to vital parts such as the face or hands, are unable to completely care for themselves.

3. No care to be rendered which will reduce the ability of the casualty to care for himself or to move under his own power.

4. All personnel who are not incapacitated to be utilized to help care for the other casualties.

I believe we must accept also the fact that interrupted communications and transportation systems will make it mandatory that each disaster area depend on itself and its remaining resources for the first two to seven days after the disaster. It would seem illogical to suppose there will be only one area affected. Rather, I would think we might have many large areas of disaster across the nation, all of which will need help. In this situation I believe the initial care of the thermally injured patient will be largely in the hands of first-aid or rescue men. Therefore, such personnel need some training.

Fig. 1.—"Rule of nines" for estimating percentage of body surface burned.

Estimation of Magnitude of Injury

The first procedure in any burn injury is to estimate the magnitude of the injury. This is largely dependent on the percentage of the body surface burned and the depth of the burn. The "rule of nines" is satisfactory to estimate the percentage of body burned and is easily committed to memory, inasmuch as it divides the body surface into areas of 9% or multiples thereof, as shown in figure 1.

The differentiation of second-degree and third-degree burns is not of as great importance to the aid man as it is to the physician who will later take care of these patients, since an extensive second-degree burn is just as incapacitating as is a third-degree burn.

Under ideal conditions of management of burns, and discounting the factors of age and concurrent disease, mortality varies with the percentage of burned surface area in a typical sigmoid curve, as shown in figure 2. There are three significant sections to this curve. It will be noted that burns of 20% or less of the body surface have practically no associated mortality. Burns involving between 20 and 40% of the body surface have a slowly rising mortality curve, but even at 40% the mortality under ideal circumstances is only about 20%. When the percentage of the body surface burned is more than 40, the mortality increases abruptly and rapidly as the involved surface increases until there is a 50% mortality with a 50% body burn and a 90% plus mortality with a 70% body surface burn.

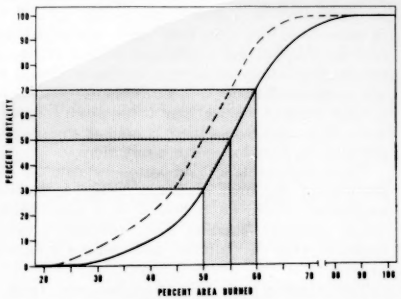

Fig. 2.—Burn mortality as related to percentage of body surface burned. Solid line shows experience at U. S. Army Surgical Research Unit and interrupted line gives data from Bull and Squire.

This mortality curve gives us a logical basis for establishing criteria for the sorting of thermally injured patients in a disaster. We have established, therefore, the following categories of burned patients and assigned treatment priorities: over 40% burn, expectant treatment; less than 15% burn, self-care; and 15 to 40% burn, maximum attention.

Thus, patients who had more than 40% of their body surface burned and in whom the probability of survival was poor, even under ideal circumstances, would be consigned to the expectant treatment group who would not have valuable medical resources expended on their early care. We would expect to come back and treat them when and as medical help, supplies, and facilities became available two to seven days after the disaster. This does not mean that the entire group would die, and we would give them such comforts as might be available from our resources, but our maximum attention would not be directed toward them.

Those patients who sustain less than 15% of body surface burn will probably survive without any treatment or at least no specific treatment until such time as more facilities become available two to five or seven days after the disaster. This is the self-care and buddy-care group.

We therefore have remaining the group with burns involving 15 to 40% of the body surface, many of whom we could hope to salvage by the expendi-

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ture of such facilities, supplies, and equipment as might be remaining in a disaster. These persons are likely to be salvaged by later definitive medical care.

Ideal Treatment and Necessary Compromises

Having established the probable incidence of thermal injury in nuclear disasters and delineated certain general policies relative to the sorting and care of injured patients, it is desirable to consider the various procedures in the ideal treatment of the thermally injured in the early postburn phase. At the same time, it must be pointed out that there are compromises which we will have to make in order to adjust to a disaster situation.

These general procedures of care in the early resuscitative phase of burn injury include sedation, provision of an adequate intravenous pathway, use of an indwelling urinary catheter, replacement of fluids and electrolytes, use of tracheotomy where indicated, prophylactic antibiotic coverage, tetanus prophylaxis, and local wound care.

Sedation.—Most seriously burned patients will receive sedation in their early postburn course. We prefer to use small doses of morphine given intravenously. Oxygen therapy also helps allay apprehension and restlessness. Obviously in disaster situations this type of sedation will not be available and the most we could hope to give would be narcotic tablets for the control of severe pain in those patients who are not vomiting and who urgently require such sedation. It by no means could be generally distributed to all casualties.

Intravenous Pathway.—An adequate intravenous pathway, preferably a plastic tubing inserted in a cut-down, is desirable for the administration of the large amounts of fluids which burned patients require. In disaster we will have neither personnel capable of performing cut-downs nor the plastic tubing to be inserted, or for that matter have sufficient ordinary intravenous infusion needles and tubing for any type of intravenous administration. Therefore, this principle will be impossible to follow even if sufficient amounts of fluid for therapy are available, which they in all probability will not be.

Indwelling Urinary Catheter.—Measurement of the hourly urinary output is the simplest and best method of determining the adequacy of fluid replacement in the burned patient. Catheters will not be available for the patients in disaster. In the maximum-attention category of patients, the amount of voided urine will have to suffice as an aid to judging the adequacy of resuscitation.

Replacement of Fluids and Electrolytes.—The burned patient is in hypovolemic shock. When this hypovolemia is not corrected, oliguria and even anuria with renal shutdown will usually ensue. Burned patients, therefore, require large amounts of fluid replacement, and we utilize the Brooke fluid formula to estimate the initial replacement requirements. This formula gives 2 cc. of colloid and electrolyte solution per percentage of body surface burned per kilogram of weight (2.2 lb.) of the burned patient in the first 24 hours, plus 2,000 cc. of dextrose in water to cover insensible losses. A burned patient weighing 150 lb. (70 kg.) and having a 30% body surface burn would require 4,200 cc. of colloids and electrolytes plus 2,000 cc. of 5% dextrose in water solution in the first 24 hours after injury. This totals 6,200 cc., and in any disaster situation it is obviously impossible to supply this amount of fluid for the large numbers of casualties. Furthermore, such solutions as are available can be used to much greater advantage in persons with mechanical trauma, where smaller amounts will do greater good for the patient. This means, therefore, that we must resort to orally given electrolyte solutions for the replacement therapy of burned patients.

The orally given electrolyte solution which is now stockpiled in the military services disaster kits is a packet containing 3 Gm. of sodium chloride (table salt) and 1.5 Gm. of sodium bicarbonate (baking soda), which when mixed with 1 qt. of water will give a hypotonic (70 mEq. per liter) sodium-containing solution. In the absence of such packets, an equivalent resuscitation solution for oral administration may be made by adding one-third of a teaspoonful of table salt and one-third of a teaspoonful of baking soda to 1 qt. of water. This solution should be administered in quantities equal to that calculated by the formula. However, many burned patients are nauseated and will vomit in the early postburn course, so that it may be impossible to get them to take a sufficient quantity of this solution. Therefore, it should be administered in small sips at short intervals. When the patient is no longer nauseated and vomiting, other food which is available may be added to the diet to supply calories and such cations as potassium which the patient will begin to require about the third or fourth day after injury. Patients in the maximum-attention group, that is, with burns of 15 to 40% of the body surface, can be resuscitated with orally given solutions, although this is not the ideal way. Their condition can be maintained in this manner until such time as definitive medical treatment facilities become available.

Tracheotomy.—All patients who have second-degree and third-degree burns about the face and neck or those with damage to the respiratory tract undergo tracheotomy early in their postburn course. In disaster situations, it is of course impractical, because of the lack of personnel trained to perform tracheotomy and the lack of the necessary equipment (tracheotomy tubes, etc.), to attempt to do tracheotomy. None should, therefore, be attempted in mass-casualty situations.

Prophylactic Antibiotic Coverage.—Penicillin and streptomycin or broad-spectrum antibiotics which will control the group A beta-hemolytic streptococci are routinely given for the first three to five days after injury to prevent a rapidly spreading erysipeloid-type infection in the exposed burn surface. Therapy with parenterally given antibiotics will, of course, be out of the question in mass-casualty situations, but it is anticipated that a broad-spectrum antibiotic such as one of the tetracyclines or even chloramphenicol could be utilized as an orally given medicament to give adequate coverage in the early postburn phase and control the streptococci which may give difficulty during this period.

Tetanus Prophylaxis.—The incidence of tetanus in burned persons is low, but it can be completely prevented by the administration of a booster dose of tetanus toxoid to those who have had previous active immunization or the administration of tetanus antitoxin to nonimmune persons. It will not be possible to give tetanus prophylaxis in the early postburn phase in disaster situations, but it would be feasible to consider giving this when definitive medical care is available two to seven days after the disaster.

Local Wound Care.—Under all circumstances, the local care of the wound is delayed until resuscitation is instituted and the patient's condition is stabilized. Ideally, at this time the burn wounds should be thoroughly washed, rinsed, and débrided of loose epithelial tissue, after which they may be managed by exposure, occlusive dressings, or, in selected cases, early excision and grafting. In disaster there will be no capability for washing and cleansing the wound, and such dressings as are available can be used to much better advantage on patients with mechanical trauma. Therefore, all burned patients in a mass-casualty situation will be treated by exposure until facilities for definitive care become available.

Possible Procedure

With this background of the many compromises which will be necessary in the treatment of thermal injury in disaster, I would like to outline more specifically my concept of the care which can be given.

1. In the early postdisaster phase, each echelon must constantly sort patients on the basis of expectant treatment, self-care or buddy care, and maximum-attention groups, utilizing the criteria set forth above.

2. Orally given electrolyte solutions must be substituted for intravenous therapy, inasmuch as orally given fluids are the only ones likely to be available.

3. All burn wounds must be managed by exposure.

4. Orally given broad-spectrum antibiotics will be employed to control early sepsis.

5. Maximal use must be made of self-care; therefore, predisaster training of as many people as possible is most desirable.

A description of the disaster kit developed by the military services has already been given by Colonel Carow (this issue, page 197). While this is suited to military purposes, it is possible that individual treatment kits (in contrast to kits for 100 persons) may be more desirable for use in civilian disasters. Such a kit or package, according to my idea, would contain (1) packets of salt-soda crystals sufficient to furnish at least 5,000 cc. daily of orally taken replacement fluid for four days (20 packets), (2) water-purifying tablets (30), (3) an antibiotic (such as a tetracycline) (four 250-mg. tablets per day for seven days, or 28 tablets); a pain-relieving tablet (two days' supply); and, of great importance, an instruction sheet.

Such treatment would be within the realm of accomplishment in a disaster situation and could be expected to insure a maximal number of survivors in the face of great disparities until definitive medical treatment facilities could be established two to seven days after disaster. At that time, special facilities for the treatment of burns should be established in a burn center. Thus, all burned survivors would be moved to one center where there could be made available specialized treatment facilities, whole-blood replacement, and high-protein diets and supplements.

Again, priorities would be established. Less severely burned patients would be given skin grafts first, since they could be prepared more easily and quickly and thus free hospital space. More seriously burned patients would receive supportive care and their conditions would be built up. They would be ready for definitive grafting when care of the less severely burned was completed. In addition to needing whole blood and high-protein diets and effective measures for the control of infection, these patients might require the use of large amounts of homografts for temporary skin cover (this might be done on the ward, saving operating room and anesthesia time and personnel) or for physiological dressings. These homografts would have to be secured largely from sources outside the disaster area, so that plans for collecting and transporting them should be an integral part of any emergency disaster plan.

Comment

Through the use of the compromises and procedure described above, it is to be hoped that a maximum number of the thermally injured in any disaster could be saved and salvaged. The success of any emergency plan, however, will largely depend on the prior planning, training, and indoctrination which has been given.

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MANAGEMENT OF SOFT-TISSUE TRAUMA AFTER A NUCLEAR STRIKE

Lieut. Col. William H. Moncrief Jr. (MC), U. S. Army

The problem of soft-tissue injury and treatment after the detonation of a nuclear weapon is complicated by several factors: the number of casualties, the types of wounds, and the effect of whole-body ionizing radiation on wound treatment and wound healing.

Before we can plan any effort we would be in a more advantageous position if we had some idea of the numbers of casualties who will be present for treatment. This is an important definition: the numbers of casualties who will be present for treatment. We all recognize that after a nuclear strike against our military or civilian populace we are going to be faced with a tremendous number of casualties. But how many of these are going to be present for treatment? Moreover, it is probable that only a fraction of this number will have soft-tissue injuries that will require early definitive surgical treatment in the classic sense. To see why this is true, we must review briefly two facts: the destructive energies released by the nuclear detonation and their perimeters, and the clinical experience from Hiroshima and Nagasaki.

The energies released in a nuclear weapon detonation are those of blast, thermal, and ionizing radiation. These energies have different radii of effect when we speak of nominal weapons (equivalent to 20,000 tons of TNT) or the larger strategic weapons with megaton (one million tons of TNT) yields. With the larger, megaton weapons, prompt radiation is of little clinical significance and the protracted thermal pulse overshadows even the blast wave. Soft-tissue injury is a result primarily of blast. The injuries seen will result from fragments of debris being hurled into people, producing abrasions and superficial lacerations and penetrating wounds. Those who are casualties from falling debris are not likely to be extricated early and may be victims of secondary fires after the initial thermal pulse and blast wave. (This emphasizes the fact that the medical load is a function not only of the yield of the weapon but also of rescue.) Moreover, these wounds from the megaton weapons will not be compounded by prompt radiation, for, as can be seen in figure 1, the effective radius of significant levels of prompt radiation is far within the radii of lethal levels of blast and thermal energy. In contrast to this situation, however, the free air burst of a megaton weapon may completely alter the radii of the casualty-producing effects. Unfortunately, in determining the biological effects from the megaton weapons, we must depend on extrapolation, for we have no experimental or clinical data as we have with the smaller, nominal weapons.

For the nominal weapons we have considerable clinical and experimental data. From figure 2 it can be seen that with the smaller weapon's detonation prompt radiation is a dominant factor. This holds true until we reach those weapons with yields of approximately two to three times that of the nominal weapons. The concept of battlefield debris being hurled into the soldiers or, similarly, bits of construction striking the civilian as a result of the blast wave from the smaller weapons has had to be modified. Extensive studies have been carried out evaluating the blast overpressures needed to penetrate the chest and abdominal wall of laboratory animals with missiles. When data on the overpressures that are required to give sufficient momentum to such debris are integrated with those on the amount of radiation that the individual would receive at the same distance from the smaller weapon's detonation, we find that we have subjected the soldier or civilian to lethal levels of radiation. These, however, are deep penetrating, or even perforating, wounds. When we move away from the weapon to sublethal levels of radiation (still confronted with significant thermal levels), we find blast overpressures that will hurl small objects with little inertia, such as glass, with sufficient force that the exposed person will incur superficial wounds—lacerations and abrasions. The severity of these wounds may be modified considerably by any clothing that the person might be wearing. This was the type of wound seen in such great numbers in the survivors of the Hiroshima and Nagasaki detonations that presented themselves for treatment. This type of wound might be present in even greater numbers after a megaton weapon detonation, where the duration of the blast is even longer.

In reviewing the medical records from Hiroshima and Nagasaki, one fails to find any description of extensive soft-tissue wounds, such as crushed limbs, and no explosive soft-tissue wounds of such nature to require surgical débridement in the classic sense. There is no mention in the medical records of laparotomy and thoracotomy for penetrating wounds, even though at Nagasaki there were intact medical facilities with this surgical capability. Personnel who had incurred this type of wound—the crushed extremity or penetrating thoracic or abdominal wound—were not seen at a definitive treatment facility. If they did not die almost immediately of their wounds, they were fatalities from the secondary fires.

Director, Division of Surgery, Walter Reed Army Institute of Research, Washington, D. C.

Clinical Course

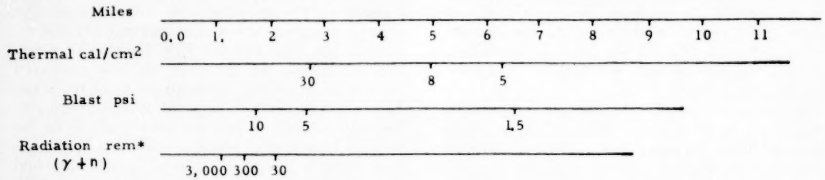
Having identified the types of soft-tissue wounds we would be faced with, can we define their clinical course, particularly if it is complicated by clinically significant levels of whole-body radiation? Turning again to the medical records from Hiroshima and Nagasaki, we find numerous descriptions of the clinical course of the healing of the lacerations and superficial penetrating wounds incurred by the Japanese. It is noted that uneventful healing of the wounds occurred except in those who received clinically significant levels of whole-body radiation. In those who received such levels of radiation and recovered, the wounds are described as having done well initially. With the onset of "radiation sickness," the wounds became exudative and necrotic: "The patient became quite weak some 14 days after the explosion. Up to this time small incised wounds had healed normally, but thereafter the wounds which were still unhealed became worse. . . ." [1] Medical notes were made that on the person's recovery from the radiation syndrome the granulations became less edematous and the wound became dry and healed: "Healing of wounds was prolonged coincident with the appearance of typical symptoms [of radiation effect] . . . the granulation tissue became anemic and edematous . . . in those who survived the granulation tissue improved again following recovery from the radiation effect." [2]

These clinical observations in the Japanese have been duplicated and expanded on in the laboratory by numerous authors. Gustafson and Cebu [3] resected a segment of ileum in dogs 20 hours after 200 r and 300 r of whole-body radiation and found no significant increase in mortality in these animals over their controls. Raventos,[4] in a study of mice challenged with an $LD_{50/30}$ (50% mortality in 30 days) of whole-body radiation and a standard laparotomy wound immediately after radiation, demonstrated retardation in wound healing as measured by tensile-strength studies. There was significant retardation of wound healing from the 6th through the 11th days after wounding, but by the 14th day there was no demonstrable difference over the controls. Radakovich and co-workers [5] measured wound closure in rats with varying doses of whole-body radiation and failed to demonstrate any retardation.

Allen and others [6] found that surgical wounds produced in dogs within two days after exposure to two levels of whole-body radiation, 250 r ($LD_{50/30}$) and 450 r ($LD_{100/30}$), showed no delayed healing. However, if these identical wounds were made five days or more after radiation, 30% of these incisions demonstrated excessive bleeding into the subcutaneous tissues, with consequent wound breakdown. These authors were of the impression that soft-tissue wounds would heal uneventfully and that any delayed healing or wound breakdown closely paralleled the pancytopenic response to radiation. This impression is borne out by studies of other groups.[7]

A much more sophisticated study dealing with statistically significant numbers of animals and evaluating wound healing complicated by whole-body radiation was carried out by Levenson and Oates.[8] These authors, by histological evaluation and tensile-strength studies, demonstrated no histological difference in wound healing in rats wounded simultaneously with 7, 14, and 21 days after whole-body radiation. However, in these wounds there was a statistically significant reduction (20-25%) in measured tensile strength.

From extensive laboratory studies and piecing together of the scattered clinical data from the Japanese casualties, it appears that we can predict the course of soft-tissue wounds complicated by whole-body radiation. With the pancytopenia that follows radiation, the casualty loses one of his principal barriers to infection. In addition, the immune mechanisms of the person are probably impaired to some degree. Because of the loss or degradation of these two mechanisms of defense, the wounded and irradiated person must depend more on the intact epithelium as a defense against the morbidity, and possible mortality, of infection than on his inherent ability to immobilize and destroy in-



*This excludes massive down-wind fall-out

Fig. 1.—Radii of thermal (calories per square centimeter), blast (pounds per square inch), and ionizing radiation effects from a 1 megaton nuclear weapon (surface burst).

vading organisms. Superficial lacerating wounds of such a nature that their edges approximate themselves soon after occurrence should heal uneventfully except in those persons who have received a lethal dose of radiation. Even in those who have received a lethal dose of radiation, if clean lacerations and surgical wounds are closed within 24 hours of wounding there is every reason to believe that these wounds will remain closed until the terminal stages. Avulsed wounds and abraded wounds that do not lend themselves to early closure will eventually heal in those persons who have received sublethal radiation, but the wound goes through a stage of retrogression coinciding with the hematopoietic response to radiation. It is during this period that the danger of systemic bacterial invasion via the open wound becomes a distinct possibility. In the débrided wound left open, with the systemic response to radiation there is progression of the wound and the granulations become anemic, edematous, and necrotic.

Preparation for Treatment

Knowing the types of wounds to expect and the clinical course of these soft-tissue wounds compounded by radiation, what can we prepare for?

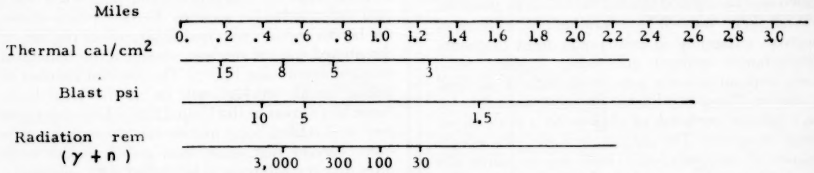


Fig. 2.—Radii of thermal, blast, and ionizing radiation effects from a "nominal" weapon (20-kiloton free air burst).

It appears that after a nuclear weapon detonation we are not going to see, for treatment, the large numbers of persons with explosive, high-velocity wounds and crushing injuries that will require débridement in the classic sense. The greater number of wounds by far will be lacerations and abrasions and will be cared for in a "minimum-care" treatment facility. In the few needing débridement who might arrive for treatment, it can be done as we have learned from our World War II and Korean war experiences. Sutured wounds will have to remain so beyond the normal 6-to-10 day period if we can extrapolate from our reduced-tensile-strength studies in the radiated animals.

Wounds in the irradiated person that need débridement will be a problem, however. In the past we have been taught that the ideal time for secondary closure of the débrided wound is from four to seven days after débridement. Laboratory studies and the Japanese clinical data indicate that to carry out a secondary closure of the wound at this time—a time when the systemic response to whole body radiation is at its beginning maximum—would definitely be harmful, and probably fatal. In the patient with the débrided wound, or the avulsed wound, definitive surgery will have to be postponed until he has recovered from his radiation effects, anywhere from three to eight weeks after wounding. We should be prepared to treat the open wound topically, as well as the patient systemically, to combat the secondary infection which contributes so much to the morbidity, and frequently to the mortality, of the wounded and irradiated casualty.

No effort has been made to define problems other than those of immediate radiation from the nuclear explosion. Still a great unsolved problem from the treatment standpoint will be the effect of chronic exposure from fall-out from the larger, megaton weapons. What will be the effect on wounding and wound healing when the person must live and work in an environment of low levels of whole-body radiation? Preliminary data from studies of laboratory animals exposed to chronic low levels of radiation for periods of up to 90 days reveal essentially no difference in the healing of experimental wounds.[9] This leads to a preliminary assumption that we have no reason to doubt that the response to wounding in the face of chronic low-level radiation will be any different from that associated with short-term radiation. Our best guide to the wound and its treatment will be the hematopoietic response to radiation.

Summary

It is felt that persons with high-velocity soft-tissue wounds requiring extensive surgery may not be seen for treatment after detonation of a nuclear weapon. Those seen will have lacerations and superficial penetrating wounds. Simple lacerations and surgical wounds having their edges approximated before the maximum response to radiation has set in should heal well. Open wounds will retrogress during the pancytopenic response to radiation, and, if the casualty is not a fatality from secondary infection in the interim, these wounds will heal with recovery from radiation.

Data in figures 1 and 2 are adapted from "Effects of Nuclear Weapons," Pamphlet 39-3, Department of the Army, June, 1957.

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PUBLIC HEALTH ASPECTS OF PREVENTIVE MEDICINE AND DISASTER

Col. Philip R. Beckjord (MC), U. S. Army

During this symposium a great deal has been said about the proposed management of mass casualties after a major disaster. This phase will presumably be transient; in a relatively short period after an attack by nuclear weapons the dead will have been buried and the injured treated to the extent possible.

What then? We will have thousands or millions of survivors struggling to exist under most desperate circumstances—without safe water supplies, with waste-disposal systems gone, with little or no food or shelter. These conditions are most favorable for the explosive outbreak of disease on a scale never before imagined. The ancient scourges, the classic plagues of antiquity, may well rise to affect the population—typhus, typhoid, dysentery, tuberculosis—perhaps even plague or cholera. Truly then we will be faced with perhaps an even greater problem, the survival of the survivors.

Responsibilities

In the final analysis the greatest responsibility falls on the individual citizen, and it is the duty of all of us in medicine and the military services to give him the facts, teach him, and hope that he will do the very best he can for himself and his family if and when an attack occurs.

We in the military fully expect to be called on to give whatever assistance we can to the civilian economy in the event of a major blow to our nation. It is certain that with perhaps 85% of our national medical personnel resources wiped out in a saturation attack on our large cities and with transportation, communication, and medical supplies at a premium, the reorganization of the nation's health services, including those of the military, will demand top priority and able administrators.

Assistant Chief, Preventive Medicine Division, Office of the Surgeon General, Department of the Army, Washington, D. C.

Organization

Major responsibilities for civil defense are vested in the states. Since we are discussing preventive medicine and public health services, we might look at a recommended organizational plan for a state civil defense health services division which shows the health services required as a result of the use, or threatened use, of nuclear, chemical, or biological warfare agents (see figure). The greatest number of public health workers will be at the local level. Since large areas of the United States have relatively few well-staffed local public health services, it is quite certain that most local public health units after disaster will have to be staffed with volunteers. This brings me to the next point, which concerns personnel.

Personnel

The most important resource in the United States for preventing or combating disease under any circumstances is our medical and paramedical personnel. Let us review a few figures, based on the assumption that 70 critical target areas composed of 92 cities will be severely hurt in any future attack. These critical areas contain 50% of our population, 45% of our hospitals, and 50% of our professional health personnel. Remember, I am talking of civilian and not military resources. It has been

TABLE 1.—*Preventive Medicine and Public Health Personnel, United States, 1958*

Category	State and Local Health Departments	U.S.PHS	Total
Physicians	2,088	1,827	3,915
Nurses	15,223	2,474	17,697
Sanitary Engineers	1,028	312	1,340
Veterinarians	343	54	397
Total	18,682	4,667	23,349

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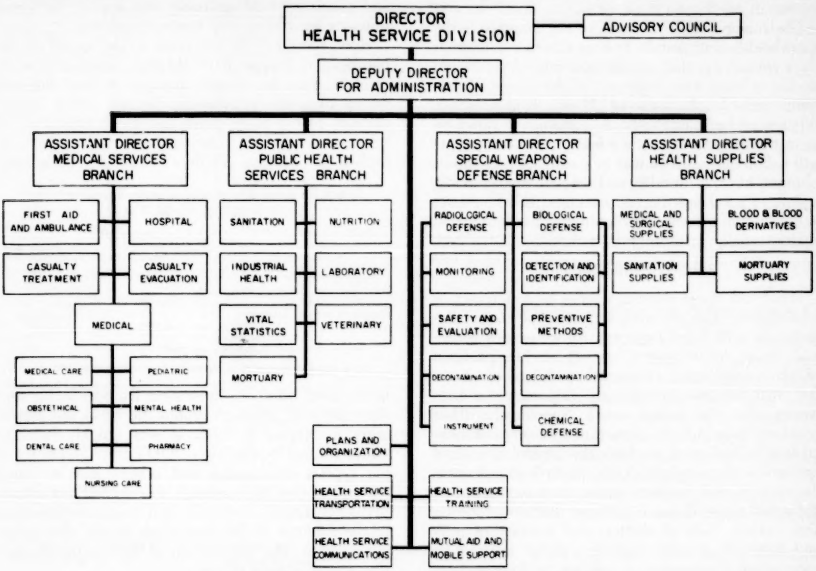
estimated that if these 70 critical target areas were bombed without warning, 13 million persons might be killed outright, 8.2 million injured who would survive 24 hours, and 5 million injured who would survive longer. This does not include expected casualties from possible fall-out.

The number of physicians, nurses, dentists, veterinarians, and other medical and paramedical personnel in the United States has been reviewed by others and is fairly common knowledge. These figures will not be reiterated here; however, a closer look at our resources in preventive medicine and public health personnel, both civilian and military, is pertinent (table 1).

Other Public Health Resources

Other than personnel, another very important public health resource is the laboratory. We have many laboratories in the United States at the federal, state, and local level and a multitude of private laboratories in addition. Yet it is clear that the same problem will arise with these as with personnel. Most of our great federal and state laboratories are in centers of dense population and would be destroyed in the event of a saturation attack. Thus, it is likely that we would have to press our hospital laboratories in the smaller communities into service for diagnostic assistance when they could spare the time for these services from their more pressing duties of blood typing, making of solutions for parenteral administration, and the like. In scrutinizing the geographical distribution of our own Army area laboratories, it is immediately noted that all of them are within target areas. We in the military might be more fortunate in having a number of our post hospital laboratories escape, unless military posts will also be defined targets, which may well be the case.

One should also speak of medical and food supplies and stockpiles as resources in the preventive medicine sense. A number of our state civil defense organizations have accumulated large medical stockpiles, as has the Office of Civil and Defense Mobili-



Health service functions of state and local civil defense organizations.

This type of personnel, as you see, is very few in number and, no doubt, as high a percentage of these persons would be killed as of other types of medical personnel in nuclear assaults—estimates as high as 85% have been made. What this fact emphasizes to me is the urgent need for training of the population in self-help and personal and environmental hygiene measures under primitive conditions. I will discuss this subject a bit later. Furthermore, public health officers are primarily physicians, and they will be just as busy as any other surviving practicing physicians in giving immediate succor to the wounded in the early phases of the attack. This, of course, will be true also of the nurses, dentists, veterinarians, sanitarians, and others.

zation. These supplies have been strategically scattered throughout the country, presumably out of target areas. These medical stockpiles include bandages, plasma, hospital equipment, special foods, cots, blankets, surgical instruments, drugs of all types, and sanitary supplies. To the best of my knowledge there is no very considerable stockpile of biologicals, particularly of vaccines, as the rotation problem involved with such perishable items is, no doubt, too enormous for practical consideration. Since 1953, almost 2,000 emergency hospitals for civil defense have been stockpiled in the United States. These hospitals, as you may know, are packaged and will accommodate 200 patients when set up.

The major health resource of the country is the good health of its people. Stating this fact in another way, we can say that we are extremely fortunate in having a very low reservoir of the major classic communicable diseases of Western civilization. What may be maliciously, or naturally, visited on us in this respect is another matter, but our people will suffer the insult of war in a state of good nourishment, at least initially, and empirically speaking, a state of good nutrition is presumed to be an asset in fighting off disease. Further, many are immunized against smallpox, diphtheria, tetanus, and typhoid.

Public Health Problems

What will these resources serve to counteract or rehabilitate? Let us consider some of the health problems which are expected to occur in a future war. Again, let us ignore the very obvious problem of trauma and speak of secondary things which we feel will become increasingly important as time passes after the initial attack. Specifically, these problems may include marked disturbances of mental health, biological warfare, the control of natural epidemics, chemical attack, the hazards of radiation, destruction and contamination of water supplies, disrupted waste-disposal systems, plagues of insects and rodents, lack of shelter, and scarcity of milk and food. Since other aspects will be covered by succeeding discussants, I will try to limit my remarks to the control of communicable disease, environmental sanitation, and nutrition. It is admittedly difficult to refrain from discussing biological warfare, since, in some respects, the difference between enemy-induced epidemic disease and naturally occurring epidemics after disaster may merely be a quantitative one. Although we have had little recorded experience with biological warfare, we do know a good deal about the epidemiology of naturally occurring disease.

Communicable Disease

The season of the year will have some influence on the disease situation. In the winter upper respiratory diseases of all types will likely be rampant because of the crowding and the evident return to the most primitive methods of sanitation, if any, after disaster. I think we can expect the filth diseases to return in force, especially the dysenteries and, of course, many types of skin conditions. Typhus may be a real danger because we do have a reservoir of this disease in those ex-Europeans who have once had typhus and who occasionally become ill with Brill's disease, or recrudescent typhus. All that is needed is some insect vectors and the opportunity of close contact; because of the expected crowding there will probably be much infestation with lice, and it is to be hoped that DDT and our other insecticides will still work. Other exotic scourges of war, such as smallpox, cholera, and plague, would probably not appear for some time—at least from any natural reservoir.

Now, some people will point to the record of the bombing of Europe in World War II and take some comfort that the classic diseases of war did not sweep over the population, despite rather severe damage to the large cities and much crowding of refugees. They will point to the record concerning typhus in Germany. Typhus did occur, but in relatively small numbers, in western Europe during and after the war; although typhus did break out alarmingly in Naples in 1943, it was quickly brought under control by the use of DDT through efforts of the typhus commission and others. But we must remember that this damage was spread out over a period of months and years and that, in comparison to the forecast of the magnitude of any thermonuclear attack, the destruction of both property and life was relatively minor.

TABLE 2.—*Bomb Damage to Homes (Dwelling Units) in Germany, World War II*

	Homes Hit		% of All Homes in Germany*
	No.	%	
Destroyed or damaged beyond repair	1,865,000	29	8
Damaged and rendered temporarily uninhabitable	1,355,000	26	7
Damaged but not rendered uninhabitable	2,316,000	45	13
Total	5,137,000	100	28

* Total number of homes in Germany in 1942 was 18,443,000.

In connection with crowding and lack of shelter, note too (table 2) that, although 8% of the homes in western Germany were destroyed beyond repair, it was still only 8%. I leave the percentage of the total destruction of homes after a saturation attack on 70 major target areas in the United States to your own imagination: certainly it is going to be considerably more than 8%.

You have read something about the present controversy concerning the feasibility of constructing bomb shelters. If we do build shelters, they should be well constructed, ventilated, and lighted, with safety features to protect habitants against the more common hazards of shelter existence, as well as against the more dramatic ones of radiation, blast, etc., after thermonuclear attack.

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To return to the occurrence of communicable disease after disaster, table 3 shows what some of the people in the public health service think might happen in relation to the incidence of vector-borne diseases after evacuation of a large metropolitan area, possibly in a large refugee camp. In the main, we must depend on our traditional defenses against communicable disease, as best we can: early detection, chemical prophylaxis, vaccination, isolation and quarantine, and organized public health effort. It will be a quantitative matter rather than qualitative. The task will be enormous.

TABLE 3.—*Possible Sequence of Events in Vector-borne Diseases after Mass Evacuation of a Large Metropolitan Area*

First Day	First Week
Fly bites and annoyance	Fly bites and annoyance Diarrhea and dysentery Shigellosis Salmonellosis ? Typhoid ? Epidemic pink-eye Fly larva infestations
Mosquito bites and annoyance	Mosquito bites and annoyance ? Encephalitis
Bedbugs	Bedbugs
Lice and pediculosis	Lice and pediculosis
Flea bites and annoyance	Flea bites and annoyance
Tick bites and annoyance	Tick bites and annoyance Tick paralysis
Chigger and mite bites	Chigger and mite bites Scabies on increase Grocers' itch
Rat bites	Rat bites ? Rat bite fever Spirochetal jaundice (Weil's disease)
After First Month	**First Month plus Biological Warfare**
Fly bites and annoyance	Fly bites and annoyance
Diarrhea and dysentery Shigellosis Salmonellosis Amebiasis	Diarrhea and dysentery Shigellosis Salmonellosis Amebiasis
Typhoid	Typhoid* Cholera*
Epidemic pink-eye	Epidemic pink-eye
Fly larva infestations	Fly larva infestations
Mosquito bites and annoyance Malaria Encephalitis	Mosquito bites and annoyance Malaria* Encephalitis* Yellow Fever* Dengue*
Bedbugs	Bedbugs
Lice and pediculosis	Lice and pediculosis Epidemic Typhus*
Flea bites and annoyance Murine typhus	Flea bites and annoyance Murine typhus Plague*
Tick bites and annoyance Tick paralysis Spotted fever Tularemia	Tick bites and annoyance Tick paralysis Spotted fever Tularemia
Chigger and mite bites Scabies Grocers' itch ?Rickettsial pox ?Encephalitis	Chigger and mite bites Scabies Grocers' itch ?Rickettsial pox ?Encephalitis
Rat bites Rat bite fever Spirochetal jaundice	Rat bites Rat bite fever Spirochetal jaundice

*Introduced by enemy agents

Public Health Aspects of Radiologic Defense

Although Colonel Maxwell is going to discuss radioactivity, I do feel it is proper to make a few comments on this subject from the preventive medicine viewpoint. As we all know, the very serious problem of radioactive fall-out is of very great concern, since we know now that a radioactive cloud from a ground or near-ground burst can cover a good many square miles of territory with a lethal rain of fission products. Such matters as detection, lethal dosages, decontamination, protective shelters, time factors of exposure, shielding, and meteorology are all very important and are being intensely studied. Sadly enough, from the preventive medicine standpoint, we as yet have no prophylactic drugs which will protect us against the effect of ionizing radiation; the inevitable fate of one who has received a lethal dose of radiation, despite any and all treatment, is sadder still. Yet in the domain of public health we do feel that water supplies and food supplies can be largely protected from the contamination of radioactive fall-out, and there is real hope of decontamination of fall-out in water supplies.

Environmental Sanitation and Water Supplies

Experience in Europe in World War II, after bombing, showed that water supply systems in large cities, although broken in thousands of places, could usually be quickly repaired on an emergency basis and the continuity of the water supply maintained to a minimally satisfactory level. However, if we are really expecting saturation attack on our large cities with megaton thermonuclear weapons, the whole question of reestablishing a water and sewage system seems a bit academic unless we are talking about suburbs.

Dr. Abel Wolman, who is professor of sanitary engineering at Johns Hopkins University, has pointed out the great need for standardization of equipment for water supplies in the United States and has urged that large metropolitan areas establish an interconnecting system of pipes so that survivors of the damaged community might draw water supplies from a neighboring undamaged community. I first heard Dr. Wolman make this proposal about six years ago; to the best of my knowledge very little has been done about it since.

The military and civilians, too, are accustomed to having anywhere from 50 to 150 gal. of water per person per day for all purposes, including bathing. After an enemy attack on our large cities, the individual will be very fortunate to have even a quart of water per day. The importance of having an adequate water supply, regardless of its potability,

has not been sufficiently stressed if we are to keep people alive and to suppress dysentery through personal hygiene. I wonder how many of you have figured out where you would get your own emergency supply of water if your usual source were suddenly cut off or badly contaminated? During World War II the urban Germans partly solved this problem by storing drinking water in wine casks and small street reservoirs (which were originally designed for fire fighting) and by carting cans of water from outlying, back yard wells.

The primitive methods used by the Germans in World War II helped the individual householder, but how would any surviving great hospitals today function if their water supply were suddenly cut off? In the event of mass evacuation of populations out of large cities there will undoubtedly be refugee camps established and civil defense and military agencies will have to set up engineer water points. A lot of tank trucks will be needed for distribution, and it is quite probable that a lot of railway oil tank cars will be converted to water cars. For some time individual water-purification methods may be necessary. While the military knows about this, I am afraid that civilians do not.

Have you imagined the potential plight of a typical household in a suburban area in the United States—let us say a family of six people living far enough from the center of a target area to escape severe bomb damage? Let us assume that the community power plant is out; the water system is empty; the sewage line is clogged; the gas mains are broken; it is the middle of winter and the outside temperature is about 15 F. What will these people do? They have perhaps up to 45 gal. of water in the water heater in the basement and there is water in the flush tanks of the toilets, having perhaps a total of 5 to 10 gal. On a strictly physiological basis this water should last them for a few weeks, perhaps. But how will they cook? How will they get rid of their wastes? How will they keep warm?

Despite the years of warning, it is doubtful whether the average householder has anything in his own home to take care of such an emergency other than a shovel which he could use to dig a slit-trench latrine in his back yard. He might cook in his fireplace if he has one, chopping up the furniture for fuel. For light, he might use candles, if he can find any. As for heat, he would simply have to wear several layers of clothing and go to bed early. We saw this picture in Europe in World War II, but it did not last very long. So we talk glibly of quickly reestablishing the utilities, but where and when will we get the material and replacement parts in this superholocaust?

Now, to make the problems of this average householder even more doleful, let us assume that he has had to take in at least one other family as refugees. This brings us to the problem of shelter again. Some authorities claim that talk of putting people up in huge tent cities is so much nonsense and, assuming that it would be possible to evacuate large metropolitan areas prior to a strike, the smaller communities, at least in the eastern states, could absorb the whole load with about only one extra family per house resulting. I do hope that they are right, but we had best plan on refugee camps nonetheless.

Waste Disposal

Waste disposal is a matter of degree, since we will be faced with a mass disposal problem the like of which we have never seen before. It is not only a matter of disposing of human excreta, but also of human bodies and animal bodies. The engineers are going to have to dig wide and deep with their bulldozers to prepare mass graves. Densely crowded activities such as collection points, refugee camps, hospitals, and the like will create an additional local load so that full use will have to be made of all possible forms of human waste disposal. I believe the incineration of waste will be out of the question, since fuel will be much too precious and needed for heating, transportation, and for power. We certainly are not going to be concerned about nonorganic trash. A greatly intensified garbage collecting system in settled areas will have to concentrate on removal of organic waste in order to lessen the fly problem. It is certain that under these conditions the sanitary land fill will come into its own, as will the sea and the rivers, as a means of disposal.

Nutrition

There may be a period of acute starvation in certain areas of the United States after a mass attack which, if for no other reason, would be due to a disruption of transportation. Anticrop warfare may come next. The rather helpless householder whom we described before may be reduced to standing in line for handouts at soup kitchens for quite some time or of drawing a package type of ration which requires no cooking. Harking back again to our World War II experiences, if we can plan on giving the people 1,800 calories a day in the form of an easily transportable and preparable food, we will be doing well. I remember very well in the early days of military government in Germany after World War II when, to attract German office workers to military government, we offered a 1,200-calorie noon meal as an added inducement. This meal was what the Germans called an *Eintopf*, meaning a sort of a stew wherein the entire meal is prepared in one pot and dished out into bowls and eaten with a spoon. This stew consisted primarily of cornmeal, potatoes, and either beef or fish. It was pretty dreary but quite nourishing.

Certainly, one thing we do not have to worry about at a time like this is the proper amounts of vitamins, minerals, etc.—at least for some time. Studies have been made of the feeding of the Dutch, after the period of starvation when we were trying to throw the Germans out of Holland during the

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end of World War II, and experiences in the feeding of concentration camp inmates on their liberation in Europe. The nutrition experts came to the conclusion that in alleviating starvation one does not have to worry about proper balance of carbohydrates, fat, protein, minerals, and vitamins for several months. The most important factor is to get the proper number of calories into the human. Immediately after the war the Germans got along quite well for quite a long time on mostly bread and potatoes mixed with a little cabbage, despite their howls about fat starvation.

The feeding of infants presents different problems, of course. But an infant can get along amazingly well on a gruel of water, bread, and potatoes. However, powdered milk will undoubtedly be high on the priority list for stockpiling and for flying into areas of need. Then, too, there are a good many people who normally do not know a rutabaga from a carrot who are suddenly going to find themselves avid back yard gardeners. Speaking of preparation of food, the so-called soup kitchens that I mentioned are going to be very real, and the Army will probably be busily occupied in certain areas helping to feed the civilian population as well as itself. Department of Defense and civilian defense manuals have been put out which describe some expedients in the problems of mass feeding, such as the making of huge cooking vats out of halved oil drums and fashioning serving utensils out of tin cans. Basically, these manuals describe the more primitive aspects of our own Army field mess equipment and procedures. As has been the case in disastrous wars of the past, the main dietary staple of the population will undoubtedly be bread in some form or other.

Summary

I have tried to bring to your attention the very real possibility that the preventive medicine and public health aspects of disaster may, in the long run, be more important than the salvaging of the casualties of nuclear attack by therapeutic medicine and surgery. The concept of "the survival of the survivors" must be given serious thought if America is to survive in any future thermonuclear war. The control of communicable diseases and the provision of water, food, and shelter for masses of helpless people will impose staggering problems of logistics as well as of professional guidance. The ability of the American people to survive and rally under the most primitive conditions may be the ultimate test of the nation.

Data in the tables and chart are from the following sources: table 1, U. S. Public Health Service and U. S. Army; table 2, U. S. Strategic Bombing Survey, 1945; and table 3 and chart, U. S. Public Health Service.

MEDICAL ASPECTS OF DEFENSE AGAINST CHEMICAL AND BIOLOGICAL WARFARE

Col. William D. Tigertt (MC), U. S. Army

Most of this program has been concerned with mass casualties resulting from nuclear weapons. My responsibility is to describe briefly the medical problems posed by two other methods of producing casualties; namely, chemical and biological warfare. Neither is associated with physical destruction. Using either chemical or biological warfare agents, an enemy could induce illness or death in varying numbers of personnel. Having admitted this capability, there then devolves on us, as a part of our basic medical responsibility, the requirement to be able to handle such attacks.

About the only real similarity chemical and biological warfare agents have is in the method of dissemination. The most likely use of either would be with various devices capable of producing large numbers of very small air-borne particles or aerosols. The entry of these particles into the body is through the respiratory tract or, in the case of certain chemical agents, through the skin.

For both chemical and biological agents, extremely effective respiratory protective devices are in existence (face masks). Likewise, efficient air filters have been manufactured. These physical protective devices are out of the research phase and ready to be considered for general use. I do not intend to discuss them but rather to examine the possible effects of chemical and biological warfare agents on an unprotected population.

Commanding Officer, U. S. Army Medical Unit, Fort Detrick, Md.

Chemical Warfare

The potential of chemical warfare must be given serious consideration. Even its most enthusiastic proponents admit that chemical weapons stand in third place (behind nuclear and biological weapons) as to likely choice by the enemy for use against cities of the United States.

Regardless of the degree of probability that a chemical attack will occur, it must be said without question that "it can happen here." An enemy submarine lying off Cape May, or in Hudson Bay, can easily lob missiles into Chicago. Admittedly it would take many missiles to blanket Chicago with even the most powerful chemical agents, but is it necessary to blanket the city in order to wreak profound havoc? Something approaching a minimum payload for such a missile can easily support the dissemination of the agent over a circle with a one-mile radius. The distribution of the agent within

such a circle will not be uniform, but it will be sufficient to insure that about 30% of the persons within that circle will be casualties within 60 seconds. And 30% is a sizable number of people.

The enemy can attain this effect with one of a series of gases, which he is known to possess in quantities measured in thousands of tons. The figure of 30% casualties in 60 seconds with such gases is based on the assumption that the people of Chicago do not have gas masks within immediate reach, day in and day out. I believe this is a reasonable assumption for the present. Even if masks were suddenly to become available by the millions, the same figures would probably hold; the enemy could use one of the agents which have a comparable action but which are absorbed through the skin.

Some of the typical aspects of poisoning with anticholinesterase agents are as follows: In less severe cases, miosis, bronchoconstriction, and salivation are prominent; in severe cases these signs are overshadowed by muscular fasciculations, paralysis, and convulsions.

There will usually be a wide variation in severity of cases, due to irregularities in distribution of the agent and individual differences in biological susceptibility. As a rough rule of thumb, one might expect the following results:

One-fourth of the population will have received something less than a lethal dose. They may be temporarily incapacitated (minutes or hours) by miosis, salivation, and tightness in the chest, but they will survive even if untreated.

One-fourth of the population will have received more than one lethal dose but less than three to five times it. They will be more severely incapacitated, but they will survive if they receive an immediate dose of atropine, presumably by self-injection with an atropine Syrette.

One-fourth of the population will have received rather more than three to five times the lethal dose. They can survive with atropine alone, but it will take massive doses (possibly as much as 200 mg. of atropine, or 100 of the 2-mg. Syrettes), and it must be given within three to five minutes, by intravenous, intracardiac, or intrapulmonary injection —the latter by long needle direct into the substance of the lung.

One-fourth of the population will have received something approaching 30 to 50 times the lethal dose. They will not survive with atropine alone, even after massive parenteral administration. They will need effective artificial respiration, begun immediately and continued without interruption for one to six hours. At present, no emergency means of artificial respiration will suffice in these cases except mouth-to-mouth insufflation. Further, ordinary mechanical respirators will not provide adequate ventilation in these cases. Currently available respirators are pressure-cycled, and the pulmonary impedance is so high in severe poisoning with an anticholinesterase agent that no air gets into the patient. A developmental model is under study which is volume-cycled, not pressure-cycled; it will deliver approximately 15 liters per minute into the patient's lungs, regardless of changes in pulmonary impedance.

Thus, the technical knowledge is now available to save the lives of every one of the 30% who are casualties. Yet it is evident that there are real practical problems involved.

Some of you may ask about the oximes. The oximes have shown great promise in the test tube and in the treatment of organophosphorus poisoning in industry and agriculture, but their role in therapy of acute poisoning from chemical warfare agents is not yet clear. Certainly they have no place when used alone in severe poisoning. In subacute poisoning, they will alleviate the muscular weakness; their main clinical action is to relieve the nicotine-like effects of the agent at the neuromuscular junction. In acute poisoning, use of the oximes may permit reduction in the dosage of atropine and some decrease in the total need for artificial respiration. Even so, they will probably still have to be administered parenterally, and we are still left in the following position: If the enemy chooses, he can use chemical weapons to inflict heavy casualties on our cities. And, for all practical purposes, it is "all over" within 10 minutes after the time the missile reaches the target.

One attribute of the chemical weapon, which it shares with the biological weapons, is that it selectively strikes people, and not buildings, industries, and other "things." Also, it now appears possible for the enemy to strike the people a temporary blow. Through the use of nonlethal, incapacitating agents, with either mental or physical effects, he might be able to paralyze the city, and then take it, with both the physical resources and the personnel intact.

Biological Warfare and Infectious Diseases

Turning now to biological warfare agents, there is a lag period between the time of use of any weapon and the time its effect is manifest. With nuclear weapons this lag period is measured in microseconds, with chemical agents in seconds or minutes, and for the living biological agents in hours, days, or weeks. This relatively long lag time, or incubation period, thus provides an opportunity for evasive action after the fact, for many biological agents, providing suitable plans have been made and appropriate drugs are readily available.

I can tell you, without equivocation, that under suitable circumstances, Koch's postulates have been demonstrated in the field in a predictable fashion. In theory, it is possible to cover areas measured in many square miles with such living agents.

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There is, of course, yet another side to the problem of infectious disease. I would not venture an opinion on the probability or likelihood of an enemy attack on the continental United States with biological agents, but I can guarantee that, in the event of war, all medical services will have to deal with outbreaks of infectious diseases. Their magnitude will vary, depending, among other things, on the amount of disruption of normal life.

Accepting this as an eventuality, rather than as a threat of indeterminate significance, we may outline a course of action directed toward attainment of a capability to meet the total infectious disease problem. This can be considered under four major headings.

Prevention of Disease.—For the military, there is the obvious requirement to continue the standard immunization program, which currently includes tetanus, smallpox, diphtheria, typhoid, plague, poliomyelitis, and typhus. Several of these diseases would rank high on any list of possible biological warfare agents if it were not for the current availability of immunization procedures. On the basis of studies of men being inducted into the military services, I believe it is fair to say that immunization in civil life falls significantly short of even the desired and attainable peacetime goal of vaccinating the entire population of the country against tetanus, diphtheria, and smallpox. The other components of the military immunization program could be added at a later date, as needed, if necessary planning to provide for prompt availability of vaccines were done beforehand.

To this list several special vaccines may be added, to be employed when there may be reason to use them. These include those for yellow fever, anthrax, and botulism. Serious consideration must be given to expansion of stockpiles of suitable biologicals, and there should exist, on a ready standby basis, a capability by several sources to prepare various other biologicals on extremely short notice.

It may be anticipated that new or different immunizing products will become available in the future. Very likely these will include living vaccines. However, the mass use of any new product should be considered only after experience in man has shown it to be devoid of serious side-effects.

Although under some circumstances certain antibiotics may be used to prevent the development of disease, presently this is impracticable except for selected groups of persons for short periods. Even if this were completely satisfactory for large groups, the quantities of drug required would prohibit its use. Consequently, prophylaxis for most diseases, or long-term suppressive use of drugs, should be dismissed for the present.

Treatment.—Turning now from prevention to treatment, many of the infectious diseases can readily be controlled after their onset by the early use of adequate quantities of antibiotics given by mouth. In many instances hospitalization under any circumstance is not an absolute requirement; it is certainly unrealistic under the conditions visualized in this discussion. Please let me emphasize the term "adequate quantities" of antibiotics. One ton of a broad-spectrum antibiotic will provide one period of treatment for 45,000 people. The current cost per person is about $10. The annual output of all of the broad-spectrum antibiotics in the United States is a very few hundred tons.

Adequate stockpiles of broad-spectrum antibiotics are attainable and would constitute the best single move that could be made to significantly reduce the impact of infectious diseases, regardless of how the outbreaks may be initiated. These drugs have long shelf-life and a wide variety of uses. In time to come, the current drugs may be outmoded. However, those now available are known to be effective and, in the 10 years since their introduction, no generally accepted drug has been discarded.

Personnel.—There is need for the continued development of physicians and paramedical personnel who are experienced in the handling of a variety of infectious diseases. Because of our commitments in various areas of the world, the military has certain opportunities for familiarization with infectious disease not available to our civilian confreres. Despite this, we do not consider our own program necessarily adequate and constantly are trying to increase this education and experience.

Drawing on an intimate knowledge of the interests and of the education of recently graduated physicians serving their time in the Army, I can tell you that their background in infectious disease is deficient. This is a reflection of the very low incidence of these conditions in ordinary practice and the necessity to emphasize in the overcrowded medical curriculum the problems that are met daily in our normal way of life. However this may be, it compounds the problem of handling infectious diseases in wartime. This absence of firsthand knowledge by our medical people lends an air of mysticism to these diseases and raises questions as to their appearance, behavior, and methods of control. This inexperience may be communicated to patients, and to possible patients, undermining their confidence in the capability of the medical profession. The stage is then set for medical ineffectiveness.

Since it is impossible to have all medical personnel acquainted with all infectious diseases, the alternative is to maintain this personal experience in selected members of the profession who can then provide down-to-earth, factual data for dissemination to the remainder of the group as necessary. The MEND program (Medical Education for National Defense) contains some such information and is, we believe, a step in the right direction. There is little to be gained, we think, in providing

large groups of practicing physicians with detailed information until it is essential in their day-to-day work. In short, in this area the aim must be toward the continued development of a small, well-qualified group of medical personnel, on whom the remainder can rely.

Diagnostic Laboratory and Epidemiologic Teams.—Diagnostic laboratory and epidemiologic teams are included in the workers previously mentioned but require special attention. It is obvious that for control of infectious disease outbreaks prompt recognition of the causative agent is of great value. There is, however, a less obvious but on occasion even more urgent reason for such recognition, applicable equally to military and civilian populations. This has to do with fear. When faced with an unknown, a group's reaction is unpredictable. While prompt identification of the cause of a disease picture and a statement of what may be expected may not be the complete solution, without this it is unreasonable to expect a rational reaction. This responsibility to recognize and identify disease outbreaks of whatever source rests mainly on existing federal, state, and military laboratories. Their capabilities may well require augmentation.

Summary

Methods of materially countering the effects of either chemical or biological warfare are known and are available as of today. Their application requires extensive prior planning and education. There is no reason to assume that the methods available now are the best that can be attained, providing the medical profession will face these potential threats and place them in their proper perspective. Neither chemical nor biological warfare is the equivalent of a fool's mate, but there is a price to be paid if we are to attain a known capability to protect and treat populations subject to such attacks.

IMPACT OF RADIOACTIVE FALL-OUT ON MEDICAL OPERATIONS

Col. Roy D. Maxwell (MSC), U. S. Army

Radioactive fall-out after the surface detonation of nuclear weapons has been known since the Trinity detonation at Alamogordo, N. Mex., in 1945. The harmful effects from this fall-out were noted by the discovery of radiation damage to some cattle grazing in a canyon about 20 miles from the detonation. However, the possibility of widespread hazard to humans was discounted and remained so until the accidental exposure in 1954 of personnel who inhabited some islands 150 to 200 miles from Bikini Atoll. None of the native population, or the American service men who were exposed, died from the radiation. However, much study of the problem has been made since that time, to learn more about the hazard which exists and to find the best way of protecting personnel from the dangers of radiation from the fall-out.

The effects of nuclear weapons are due to the fission of material (uranium-235 or plutonium-239) or a combination of fission and fusion, as in the thermonuclear weapon. The detonation releases kinetic energy (causing blast damage), thermal energy, and ionizing radiation energy. It has been found from the many detonations in field tests of nuclear weapons that radioactive fall-out occurs only after a surface detonation over either land or water where the fireball actually intersects the surface. The surface material becomes severely contaminated with fission products, and the particles of surface material fall to the surface at times after the detonation and distances from the detonation depending on yield of the weapon, the height of burst above the surface, and the wind structure at all altitudes occupied by the cloud. Should an extensive attack be made on the United States by a large number of weapons detonated on the surface, the area of lethal radiation to unprotected personnel would be large.

Assistant for Nuclear Warfare and Casualty Studies, Army Medical Service School, Brooke Army Medical Center, Fort Sam Houston, Texas.

Protection

The possible danger from radioactive fall-out has been widely publicized by newspapers, magazines, radio, and television. Protection from the dangers has been just as widely publicized, but understanding of the reasons for protection from radiation—other than fear of the unknown—has not been in line with the publicity given to the problem. For example, we read that to use food or water that has been contaminated with radioactive fall-out is dangerous. Thus, people are led to believe that any radioactivity may cause their death. It is true that radioactivity is dangerous, but it is also true that the National Committee for Radiation Protection has set a tolerance level for ingestion of radioactive materials in food and water, one which is not difficult to maintain provided adequate public health information is available at the proper time. This information and the procedure to follow in the event of an attack are possible only with prior planning for evaluating the problem as it is found to exist at the time after the detonation of a thermonuclear weapon.

The term thermonuclear weapon is used because these are the weapons most likely to be used on civilian populations. They are large, the amount of radioactive isotopes produced in the total detona-

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tion is great, and the total area involved in a fall-out situation far exceeds that possible for smaller weapons. The fission products formed are no different in the thermonuclear weapons than in the smaller nominal nuclear weapons. Thus, the protective measures necessary are the same, and decontamination from the materials is the same, for either a series of small nominal weapons or one large thermonuclear detonation. The difference is mainly in the number of people involved and the possible high-radiation intensity at early times after the detonation. For example, the radiation intensity at a point 30 miles from a thermonuclear detonation may be as much as 10 to 50 times as great as the intensity from the fall-out radiation from a nominal 20-kiloton detonation—other things such as terrain, height of burst, and winds at all altitudes being equal. Therefore, protection from radioactive fall-out is necessary, and understanding the problems is mandatory, if we are to survive a large-scale nuclear attack.

Protection from radiation is obtained by distance from the radiation or from material between individuals and the radiation. Distance is the protection of choice, but this is not always possible, so let us investigate the alternative—that of material. This material can be the concrete of a basement of a house or building, the dirt of a storm cellar, or dirt from a covered hole (covered with 1½ to 3 ft. of dirt). The nuclear radiation doses received by persons in various types of shelters are as follows (all calculated on the same unit of time and amount of nuclear contamination): in the open, 1,500 r; frame house, 750 r; basement of house, 150 r; in an open foxhole (for maximum protection, the person must be well below the lip of the foxhole), 120 r; medium tank, 30 r; covered foxhole (1½ ft. of earth), 5 r; and underground shelter with 3 ft. of earth covering, 0.3 r.

The problem will be food and water for persons required to live in this covering while the radiation is decaying by the natural process of the fission products. The decay is rapid during the first seven hours after the detonation but slows materially from seven hours on. As much as 90% will disappear during the first seven hours, but only about 9% of the original radioactivity will disappear during the next two days. Thus, in an area of very high-level radiation intensity, an appreciable amount of activity will remain even after the two days. To be sure of survival beyond that time, it may in many instances be necessary to stay sheltered for another two weeks. One could come out of the shelter for short periods of time after two days but not for periods longer than those necessary to resupply and then return to the shelter. Well-planned, well-stocked shelters—either individual or community—are the possible solution.

What radiation will do to personnel is not fully understood. Our information is based on the Japanese experience at Hiroshima and Nagasaki, the few accidents in atomic energy projects, and animal experimentation in the laboratory. However, we do know enough to state a few things with assurance. One is that all persons should protect themselves from all radiation possible. We can say that certain amounts of radiation will produce certain clinical conditions or symptoms. Whatever we state from the information that we have, we still will have to treat the patient as the clinical symptoms develop. We are interested, in this discussion, in the prevention of radiation sickness—not the treatment of casualties as they appear in the hospital. We are interested in protection of our medical personnel so that they will be available for treating all casualties, whether from radiation effects or from the other effects of nuclear warfare. How can we do this?

It is a requirement that the professional man know the problems, be informed of the hazard as it exists, and follow instructions for protecting himself so that he can survive. He may have to stay covered for a period of time when persons unfortunate enough to be injured are in great need of treatment. He will be immobilized during this period. But this may be the only way that the surviving population can be assured of medical care as required during the recovery of our economy. This will be hard for physicians to do when they are dedicated to caring for injuries as they occur in order to save lives.

An irradiated (but not contaminated) person is not hazardous to the rescue worker because the irradiated person is not radioactive. By the same token, it should be planned to remove radioactive particles from a contaminated person so as to not scatter radioactivity throughout a hospital and endanger other persons, both well and injured. This can be managed. We must realize that it is difficult to contaminate a single person with sufficient radioactive fall-out material to endanger either himself or the person giving treatment. However, if much contaminated clothing from many patients is not kept isolated, there will be an increasing hazard to all persons in the hospital. Thus, a decontamination center of some kind will be required. For example, if persons begin to appear at the treatment facility who are contaminated, the receiving station can be placed 50 ft. or more from the entrance of the hospital, emergency lifesaving procedures can be started by assistants, and decontamination can be accomplished prior to actually admitting the patients for definitive treatment. The contaminated clothing and water used in the decontamination procedures can be isolated and the radioactivity allowed to decay without coming into contact or even near nonirradiated personnel.

Comment

Finally, to reiterate, be alert to the problems, know the problems, and give assurance to those around you who will look to the medical profession for guidance. If you are well versed in the hazards, if you can protect yourself from the dangers of radiation, and if you keep calm in the face of a constant threat of the unknown, your attitude will be contagious. You will save lives by your attitude and your practice. To be informed, to practice what you know, and to instill confidence in others is as much of your Hippocratic oath as to treat the sick and wounded when they appear at your door.

PSYCHOLOGICAL ASPECTS OF DISASTER

Col. Albert J. Glass (MC), U. S. Army

This paper is concerned with the psychological problems of massive traumatic situations with particular emphasis on the probabilities for noneffective behavior in a disaster produced by nuclear weapons. Man has been threatened by or subjected to episodes of catastrophic trauma since recorded history. In more recent years there has been reported a considerable body of data relative to the behavior of groups and individuals under disaster conditions. Such data include numerous observations and studies of (1) combat personnel in World War I, World War II, and Korea [1]; (2) the effects of massive aerial bombardment against population centers [2]; (3) spontaneous civilian disasters such as fires, explosions, hurricanes, tornadoes, and floods [3]; and (4) the atomic attacks on Hiroshima and Nagasaki.[4] From these extensive and varied experiences it is possible to construct theoretical models that illustrate general conclusions regarding behavior under external stress which may be useful in delineating fruitful areas where prevention and management techniques can be employed.

Reactions to Danger

The first model to be explored is based on the ability of human beings in a disaster situation to receive and act on danger signals. As might be expected, persons have varying capacities in this respect which can be viewed as a continuum in the effectiveness of response to danger. While such a variation of behavior in traumatic situations has been repeatedly observed, it was perhaps most clearly demonstrated in the studies of Marshall [5] and Tyhurst.[3b] Marshall, utilizing a debriefing technique, surveyed hundreds of infantry companies in World War II and found that only 15 to 25% of combat infantrymen exhibited appropriate aggressive action in battle. Similarly, Tyhurst observed that 12 to 20% of persons exposed to a civil disaster could be considered to have functioned in an effective manner.

It seems evident that only a relative minority of persons are able to quickly grasp the relevant aspects of a danger situation and utilize this information for appropriate and constructive action. The majority of persons when confronted with the immediate threat or actual presence of a major danger are irresolute, are unable to make decisions, and characteristically are described as docile and suggestible.[2] In describing their experiences, these persons admit to suffering a subjective state of fear. In contrast, the more effective minority previously described usually state that, while tense or excited, they were too busy to remember any feelings or sensations of fear. It can be concluded that while a majority can clearly perceive the danger environment they are relatively incapable of utilizing this information for constructive purposes. Their docility and suggestibility demonstrates that a lack of decision-making ability is the major defect. Such persons literally demand leadership, and in many disaster situations the phenomenon of the emergent leader arises as a response to this demand.

Another minority of persons, probably 10 to 25%, have even more serious difficulty in coping with disaster in that they display helpless or seemingly disorganized behavior. Some of this group react to danger much like frightened small children and exhibit dependent, helpless patterns of behavior. Others make primitive efforts to escape danger by either blind flight or aimless activity. Still others psychologically withdraw from the situation and appear apathetic, dazed, or mute. Seemingly, this group of persons are either incapable of appropriate action even when given specific instructions or, as in the more severe forms, attempt to sever communication from such a terrible reality.

In the past, traditional errors have been made in the diagnosis or labeling of transient noneffective behavior under stress. Because of somatic symptoms or obvious signs of anxiety, or the even more bizarre manifestations of excitement or retardation, almost invariably such behavior has been considered similar either to the typical psychiatric categories of neuroses, psychoneuroses, and psychoses or to organic brain syndromes with descriptive terminology of a shock-like state such as "shell shock" or concussion.

Even a superficial study reveals that transient stress disorders are quite unlike the classic mental diseases that represent more or less fixed patterns of adaptation. Also, there has been no confirmation

Chief Psychiatry and Neurology Consultant, Office of the Surgeon General, Department of the Army, Washington, D. C.

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of the stress syndrome's being caused by organic brain damage. Available evidence demonstrates that psychoses and other classic mental disorders which require admission to mental hospitals do not result from exposure to external danger. Army statistical records as far back as World War I indicate that the rate of psychoses among military personnel is the same in peace as in war. There was no increase in mental hospital admissions in England during World War II despite the repeated psychic trauma of heavy bombing raids. Psychoses do not arise from spontaneous civil disasters and did not result from the atomic destruction of Hiroshima and Nagasaki. It is apparent that classic mental disease is not produced by external danger. Transient emotional reactions can begin to improve as soon as the danger subsides. They represent a temporary adaptation to a danger situation—an attempt by the organism to cope with danger by some immediate method, even if a noneffective one.

Perhaps a major reason for the previous errors in labeling noneffective responses to disaster as similar to cases of classic mental disease or organic brain disease stems from the not infrequent instances of residual apprehension that becomes apparent after improvement of the stress disorder. These persons exhibit phobic-like reactions to stimuli which in any way resemble the previous traumatic experience. The level of tension in such persons may at times be sufficiently high to produce irritability, insomnia, anorexia, or digestive disturbances and other somatic or psychological evidences of anxiety. In conventional combat such persons came to attention when units were moving forward to combat from a rear area. They either presented themselves to the medical officer because of subjective complaints or became stragglers or deserters from combat. Civilian reactions of a similar type during World War II produced phenomena of absenteeism or other evasive and escape reactions.

The majority of cases of residual phobia occur in persons who have been helpless or otherwise unable to maintain themselves during a previous disaster experience. However, such phobic-type disorders have been found to occur in persons who have proved themselves to be repeatedly effective in prior danger situations. On continued exposure to danger, they gradually become less and less able to function and finally develop crippling phobic avoidance behavior. In the Army such cases were known as the "old sergeant's syndrome." [6] A similar phenomenon was observed in England during World War II in veteran rescue workers and fire wardens who had repeatedly undergone severe bombing raids.

In summary, phobic residual problems may be present in a significant number of persons who, because of previous inability to function in disaster with its accompanying severe anxiety engendered by this helplessness, react to danger stimuli as if catastrophe had already occurred. Such persons may require special handling or management when placed in locations of potential danger.

Behavior in Various Phases of Disaster

A second conceptual model that is considered useful for the purposes of this discussion is based on the examination of behavior in the various time phases of a disaster. Such an operational model has been employed by most workers in the disaster field.[7] It has the advantage of pinpointing behavior in relation to the circumstances that existed before, during, and after disaster impact. Such a model permits an examination of the factors that may be involved in the prevention and treatment of behavioral problems at any particular stage of the disaster. The time behavior model to be presented comprises five time periods.

Preimpact Period.—The preimpact period can be said to exist whenever there is a high probability that disaster will occur and may subsume a time period from weeks to months. Such a preimpact stage would certainly be present in the event of a declaration of war between the United States and a major power possessing nuclear weapons. It might also be considered to be present during any serious international crisis which might eventuate in a sneak attack on this country.

It is characteristic for behavior during the preimpact period to consist of underactivity or noneffectiveness insofar as taking constructive measures to prepare for disaster impact. Man ever seeks to lower his level of tension. To consider seriously the prospect of being confronted by a massive destructive agent can only increase one's level of anxiety. Therefore, it is not surprising that during the preimpact period most persons either deny that such a problem exists or adopt a fatalistic concept which allows them to make no preparation for disaster or to adapt various rationalizations which prove to them that such a catastrophic event will never occur. Prior to World War II all of these attitudes were well known and could be included under the "it can't happen here" attitude.

It is perhaps difficult to argue that such disinterest or apathy is abnormal, since efforts to decrease anxiety are considered desirable and acceptable. In fact, all cultures have found substances either to inhale or ingest which decrease emotional tension. Their use continues, even though such tranquilizers as alcohol and cigarettes are said to have dangerous consequences. Therefore, while one cannot state that underactivity in the preimpact period is an abnormal mental state, it is clearly noneffective insofar as adequate preparation for disaster is concerned.

Military service has long recognized the need to insist that a soldier be trained for battle regardless of whether he considers it tedious, boring, or anxiety-producing. Experience has repeatedly shown that failure to indoctrinate troops for battle is to lay

the groundwork for their later noneffectiveness and lessen their chances for survival. A similar type of training is conducted for emergency situations in civilian life such as fire, explosion, and shipwreck. It has been repeatedly demonstrated that a population prepared with the knowledge of what to expect in a disaster and the proper defensive and evasive measures that may be taken will exhibit a much smaller degree of noneffectiveness. Similarly, persons who undergo traumatic events without becoming helpless or otherwise immobilized are better able to cope with a future episode, since in effect they have learned by experience. One may not be immunized to danger; however, one can learn the practical steps that offer the best chances for survival. One can conclude that the best method of preventing noneffective behavior in disaster lies in planning and training for such an eventuality. While this is a relatively unpalatable preventive technique, it is the only method that has merit. Such training when performed by groups who may face a future disaster together has other benefits. It demonstrates to the person that he or she does not face danger alone. It creates group cohesiveness or solidarity which exerts social pressure on the individual to perform effectively for the group or community welfare and negates tendencies toward behavior devoted to self-interest.

Warning Period.—The warning period is that of imminent danger, usually minutes or hours in duration. Noneffective behavior during this time is generally manifested by overactivity. Unprepared persons and groups frantically seek information as how to best evade the forthcoming impact. For the persons involved, the receipt of communication as to the best action to be taken becomes of utmost concern. Leadership is also of vital importance, since, in effect, the leader serves as an agent of communication who indicates by verbal or nonverbal means the direction and type of activity that offers the best chances of survival.

Not infrequently, overactive behavior during this period is described as "panic." As usually employed, the word "panic" covers a wide variety of general behavioral phenomena from headlong flight to apprehensiveness and includes restlessness, tearfulness, and the like. In its more limited and correct usage, panic denotes irrational behavior in which judgment and consideration of reality factors are so poor that self-destructive activity may occur. True mass panic occurs when a group of persons fleeing from imminent danger find their escape route impeded or blocked. Under these circumstances they lose all sense of judgment and discretion. They become impervious to communication or direction, trample over one another, and fail to seek other exits of escape even if available. For these reasons mass panic rarely occurs in outside disaster circumstances.[8] Examples of mass panic situations are fire in a theater, school, or factory.

It should be understood that flight in itself cannot be considered abnormal behavior. In fact, flight may be the best survival technique under a given circumstance. More important is whether the person flees in the proper direction or utilizes good judgment in deciding whether to take flight or seek shelter, considering the amount of time involved and the nature of the disaster agent.

To summarize, prevention and management of noneffectiveness during this period are based on (1) previous planning and preparation by the exposed population; (2) adequacy of the communication network; and (3) the presence of capable leaders who can grasp the relevant aspects of the impending danger and transmit to their followers the appropriate defensive or evasive measures that should be followed.

Impact Period.—Little is known of behavior during a brief impact period such as would occur in a nuclear detonation. Under these conditions persons involved are buffeted or thrown about and generally are unable to control the situation by their own efforts. However, previous training may permit automatic-type movements such as diving for shelter and covering the eyes.

Recoil Period.—During the period immediately after impact the individual has time to recoil as it were, take stock of himself, note the condition of his surroundings, and begin to initiate constructive activity. Usually recoil occurs within minutes. When recoil is delayed there is typical underactivity with helplessness, aimless wandering, dazed apathy, or mute, motionless behavior. These manifestations have been frequently referred to as the disaster syndrome or disaster fatigue.[9] Persons with such a disaster syndrome or delayed recoil cannot cope with the secondary disaster effects of fire or the collapse of buildings. From a military standpoint they are of little value to the members of their unit, who must promptly reorganize for an expected enemy attack that would be expected to follow the use of a nuclear weapon. Behavior during this period becomes of considerable importance in any civil disaster, since the relatively uninjured survivors are the only immediately available personnel who can perform rescue and other prompt and resuscitative measures.

In this period as in the warning period, techniques of prevention and management are based on the adequacy of communication and leadership. Communication must be used repetitively in transmitting information as to what has occurred and the appropriate steps to be taken. Leadership again serves as an agent of communication to more concretely impart the necessary data for effective action. When rescuers move into a disaster area or when emergent leaders arise, they are able to shorten the period of recoil for most disaster victims.

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Persons with more severe cases of the disaster syndrome are usually sent to medical installations such as aid stations and hospitals. Because such persons cannot be influenced by the usual means of communication, they are considered to have an illness, since they seem "shocked" and unable to respond to even simple direction. As previously stated, it is important that such cases not be considered in the same light as the classic mental disorders. They represent a temporary breakdown in the ability to receive and act on communication and are not products of the internalized conflict which is characteristic of psychoneuroses and psychoses. Experience has repeatedly demonstrated that these transient disorders are best treated as soon as possible and as near the disaster site as possible. These persons must be helped to master and overcome difficulties in the current situation. Evacuation and hospitalization only confirms to the individual his helplessness and indecision. The most effective techniques are simple efforts to reestablish communication between the person and his environment.

For these purposes it is important to supply warm liquid food in the form of soup, coffee, and the like —the most ancient of communication devices. The person is permitted to lie down and rest for several hours and encouraged to air his experience. Only simple questions are asked and no effort is made to explore the individual's background or predisposition. A mild sedative may be useful as a symbolic means of reassurance. Stronger doses of sedation only increase the communication barrier. Under this simplified regimen, given in an atmosphere of expectancy for recovery, within hours, or at least overnight, the vast majority of persons slowly "recoil" and regain effectiveness if given simple tasks to perform under supervision.[9] As stated previously, such persons may later manifest varying degrees of residual apprehension.

Postimpact Period.—The last disaster stage, the postimpact period, continues for months after recoil as the individual begins the task of rehabilitation for himself and others. Characteristically there is a rising tide of activity. Persons who have lost loved ones, their homes, or valuable possessions slowly begin to appreciate the extent of their problems. Grief reactions do occur, but in general there is more of a tendency to anger or resentment. Anger and resentment are commonly directed against local authority or whatever agency persons can blame for their predicament. In a civilian setting the problems of social disorganization are uppermost. Emergency housing and feeding must be provided. Cases of residual apprehension arise, particularly if there is probability of repetition of the disaster impact. Initially during this period persons move toward each other and positive group feelings occur. Later there may be recriminations as anger seeks convenient targets. Outsiders who have not suffered from the disaster may unwittingly find themselves the targets of such resentment.

Summary

This paper has endeavored to portray the problems of noneffective behavior that may be expected in a disaster created by nuclear weapons. Experiences from massive traumatic situations in war and peace have been utilized to construct two conceptual models which permit examination of various pertinent factors that are concerned with the effectiveness of individual and group response to danger. One such model concerns the relative frequency and types of effective and noneffective reactions to disaster situations which may be expected from an average population sample. A second conceptual model is based on an examination of behavior in the various time phases of a disaster. These models permit an exploration for methodology relative to the prevention and management of disaster psychological problems.

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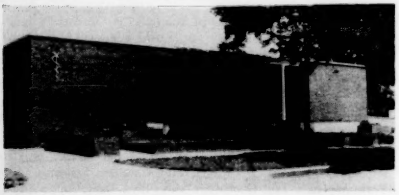
MEDICAL NEWS

ALABAMA

New Headquarters Building.—After 10 years of renting and borrowing space, the Medical Association of the State of Alabama is now housed in a one-story building at 19 S. Jackson St., Montgomery. The association's staff moved into the 5,000 square foot building Feb. 26. The property on which the building is erected consists of two lots containing 17,000 square feet located in the vicinity of St. Margaret's Hospital, about two blocks behind the State Capitol. Drs. Luther L. Hill, Montgomery, chairman, Edgar G. Givhan, Birmingham, William R. Carter, Repton, Douglas L. Cannon, Montgomery, and Daniel G. Gill, Montgomery, served on the building committee. Serving in an ex-officio capacity were Drs. Justus M. Barnes, Montgomery, and Robert Parker, Montgomery, and Executive Secretary Mr. William A. Dozier Jr. This building



is of hollow tile and brick construction, and is faced in oriental charcoal gray bricks and trimmed in limestone. The front of the building features a portico on which sculpture bronze busts of Dr. Jerome Cochran and Dr. William Henry Sanders will be mounted on pedestals in memorial of these two Alabama physicians. The total area of the air-conditioned building is divided into three sections, reception, working, and conference. The conference room is equipped with a three-way direct and indirect lighting system. The H-shaped building contains six offices, a workshop for the *Journal of the Medical Association of the State of Alabama*, a clerical-supply room, a machine room, and a large storage room. Construction allows for ample off street parking. Total cost of the construction was $91,785.82.

COLORADO

Dr. Talmage Named Allergy Head.—Dr. David W. Talmage was appointed as a professor in the department of medicine and head of the division of allergy, University of Colorado School of Medicine, Denver. Dr. Talmage comes to Denver from the University of Chicago, the School of Medicine, where he was associate professor of medicine and head of the allergy division.

CONNECTICUT

Clinical Meeting in New Haven.—The 34th clinical congress of the Connecticut State Medical Society and the Yale University School of Medicine will be held Sept. 30 at the Grace–New Haven Hospital and the Yale School of Medicine, New Haven. Clinical pathological conferences will be conducted by Drs. Harry M. Zimmerman, New York City, and Ivan L. Bennett Jr., Baltimore. The program includes the following papers:

Detection of Bleeding and Clotting Problems in Children, Dr. Louis K. Diamond, Boston.
Present Status of Immunization with Oral, Live, Attenuated Poliovirus Vaccine, Dr. Albert B. Sabin, Cincinnati.
Management of Cardiac Arrest, Dr. Hugh E. Stephenson Jr., Columbia, Mo.
Rational Blood Replacement in the Surgical Patient, Dr. Fred H. Allen Jr., Boston.
Hyperexia Nervosa, Dr. Alvan R. Feinstein, New York City.
Chemical Studies and Anxiety, Dr. Mandel E. Cohen, Boston.
Heart Disease in Pregnancy, Dr. Harold Gorenberg, Jersey City, N. J.
Urinary Tract Infections, Dr. Paul B. Beeson, New Haven.

Registration fee for society members is $5. Hospital residents and interns will be admitted free.

FLORIDA

Dr. Norton Named Ophthalmology Head.—Dr. Edward W. D. Norton, Miami, was named professor and chairman of the department of ophthalmology at the University of Miami School of Medicine, Coral Gables. The newly formed department was formerly a division of the department of surgery. Dr. Norton came to Miami in 1958 as associate professor of ophthalmology. He is a graduate of Harvard and Cornell University Medical College.

IDAHO

Dr. Hoopingarner Named Secretary.—Dr. James L. Hoopingarner, of 104 N. Latah St., Boise, succeeded Dr. John T. Brunn, Meridian, as secretary of the Idaho Academy of General Practice.

IOWA

General Practice Meeting in Des Moines.—The Iowa Chapter of the American Academy of General Practice will hold its 11th annual meeting at the Hotel Savery, Des Moines Sept. 27-29, with topics selected on the basis of interest to general practice

Physicians are invited to send to this department items of news of general interest, for example, those relating to society activities, new hospitals, education, and public health. Programs should be received at least three weeks before the date of meeting.

and with speakers selected on the basis of their authority. Two luncheon speakers are scheduled: Dr. George D. Ludwig, Iowa City, presenting "Cardiac Arrhythmias," and Miss Frances Colflesh, presenting "What's Your T. Q.?" The annual banquet will be held the evening of Sept. 28, preceded by a social gathering.

KENTUCKY

Annual Meeting in Louisville.—The Kentucky State Medical Association will hold its annual meeting Sept. 22-24 at the Columbia Auditorium, Louisville. Dr. Foster D. Coleman, president, Jefferson County Medical Society, will present an address at the opening general session, with the president's address by Dr. Robert W. Robertson, Paducah, to be given later that morning. The following panels and moderators are planned:

Biliary Tract Disease, Dr. Malcolm M. Stanley, Louisville.
Integration of Home Care Services into the Public Health Program in the County Health Departments, Dr. Edwin Cameron, Louisville.
Reversible Renal Failure, Dr. Beverly T. Towery, Louisville.

Dr. John H. King, Washington, D. C., will present "Ocular Inflammation" with a movie, to be followed by a motion picture, "Whale Electrocardiogram." A clinical pathological conference Sept. 23 will be moderated by Dr. John D. Allen Jr., of Louisville. Six specialty groups will present scientific programs the afternoon of Sept. 22 and the morning of Sept. 24. Exhibits are planned. At the presidents luncheon Sept. 23, Dr. Frank B. Berry, Washington, D. C., will present, "Activities of the Office of the Assistant Secretary of Defense (Health and Medical)."

MICHIGAN

State Session in Grand Rapids.—The 94th annual session of the Michigan State Medical Society will be held Sept. 27-Oct. 2 at the Pantlind Hotel and the Civic Auditorium, Grand Rapids. Out-of-state speakers who will present papers at the general sessions are as follows:

Dr. Robert L. Faulkner, Cleveland; Dr. Isador Dyer, New Orleans; Dr. Ivan H. Smith, London, Ontario, Canada; Dr. Edward M. Dorr, Chicago; Dr. Charles B. Puestow, Chicago; Dr. Vernon L. Guynn, Chicago; Dr. Aaron B. Lerner, New Haven, Conn.; Dr. Lorand V. Johnson, Cleveland; Dr. Tracy O. Powell, Los Angeles; Dr. Samuel Livingston, Baltimore; Dr. Leo J. Wade, New York City; Dr. John A. Rose, Philadelphia; Dr. Howard P. Rome, Rochester, Minn.; Dr. John G. Young, Dallas, Texas; Dr. Jerome A. Hilger, St. Paul; Dr. James H. Hughes, Memphis; Dr. Thomas P. Findley, Augusta, Ga.; Dr. Carl Muschenheim, New York City; Dr. Michael L. Furcolow, Kansas City, Mo.; and Dr. Frederick G. Germuth Jr., Charlotte, N. C.

The Andrew P. Biddle Lecture will be given by Dr. Clarence Cook Little, Ellsworth, Maine, presenting, "Some Biological Considerations in Chronic Disease." A surgery panel, "Pancreatic and Biliary Disease," is planned for the morning of Sept. 30. A dinner dance will be held Sept. 30 at 7 p. m. Technical and scientific exhibits are planned. A ladies' program is arranged.

NEW YORK

Dr. Gardner to Give Hutchings Lecture.—Dr. George E. Gardner, director of the Judge Baker Guidance Center, Boston, will deliver the 11th Richard H. Hutchings Memorial Lecture at the College of Medicine, University of the State of New York Upstate Medical Center, Syracuse, at 8 p. m., Monday, Oct. 5. The lecture is one of a series sponsored by a group of Dr. Hutchings' colleagues and friends. Dr. Hutchings, who died in October, 1947, was professor emeritus of clinical psychiatry at the Syracuse University College of Medicine. Dr. George L. Warner, Marcy, director of Craig Colony, New York State institution for epileptics, will deliver the customary short eulogy on Dr. Hutchings which accompanies the formal lecture. Dr. Warner, as a young physician, served on the Utica State Hospital staff under Dr. Hutchings for seven years. The memorial lectures are open to all members of the medical profession and to all medical students.

New York City

Bluestone Professorship.—Under the will of the late Dr. Moses A. Bluestone, of Brooklyn, the Dr. Joseph I. Bluestone Professorship in Experimental Medicine was established in the Hebrew University, Jerusalem, Israel, in memory of his father who was a founding physician of the Beth Israel Hospital in New York, and practiced medicine there from 1890 until his death in 1934.

Medical Advertising Course.—For the fourth successive year New York University offers an evening course in medical advertising and promotion. Conducted by Dr. Philip Reichert, the course meets for 15 sessions, Monday evenings from 6 to 7:45 p. m., starting Sept. 28 at the Washington Square Center. Practical analysis of current advertisements from leading medical and pharmaceutical media is one aspect of the course. The techniques of launching a new ethical product are outlined. For a brochure of this course, write the Division of General Education, N. Y. U., Washington Square, New York 3 (call SPring 7-2000, extension 8120).

Dr. Klemperer Honored.—Dr. Paul Klemperer, consulting pathologist, Mt. Sinai Hospital, was awarded the Groedel Medal by the American College of Cardiology at its annual meeting in May in Philadelphia. The Groedel Medal is given at the presentation of the annual lecture in honor of Dr. Franz Groedel, founder and formerly president of

the American College of Cardiology. The subject of Dr. Klemperer's address was "The History of Coronary Sclerosis." On June 12 Dr. Klemperer was awarded an honorary degree of doctor of science by the University of Chicago.

OHIO

Anesthesiologists Meeting in Dayton.—The annual meeting of the Ohio Society of Anesthesiologists, Inc., will be held Sept. 18-19, at the Dayton Biltmore Hotel, Dayton. The program has 11 papers listed, including "The Use of Fluothane in Obstetrical Anesthesia," by Dr. Benton D. King, Buffalo, N. Y. A panel discussion, "Circulation to Vital Organs," is planned for the morning of Sept. 19. President of the society is Dr. Sidney Katz.

OREGON

State Session in Medford.—The 85th annual session of the Oregon State Medical Society will be held Sept. 23-25 at the Medford Memorial Armory and the Rogue Valley Country Club, under the presidency of Dr. Herman A. Dickel, Portland. The program lists the following as guest speakers:

Dr. Conrad G. Collins, New Orleans; Dr. Leo E. Hollister, Palo Alto, Calif.; Dr. Ernest Jawetz, San Francisco; Dr. K. Alvin Merendino, Seattle; Dr. A. Waite Bohne, Detroit; Dr. Donald A. Dukelow, Chicago; Harrison Clarke, Ph.D., Eugene, Ore.; and Dr. Walter Freeman, Los Altos, Calif.

Panel discussions on open heart surgery and urinary incontinence are planned for the morning of Sept. 24. A ladies' program is arranged and entertainment will include fishing, sightseeing, and golf. Scientific and technical exhibits are arranged. For information write Mr. Roscoe K. Miller, 1020 S. W. Taylor St., Portland, Ore., Executive Secretary.

TEXAS

Professors Emeriti.—Effective Sept. 1, three professors at the University of Texas Medical Branch, Galveston, assumed the position of professor emeritus: Dr. Willard R. Cooke, professor of obstetrics and gynecology, who was appointed lecturer in obstetrics and gynecology in 1913 and served as professor and chairman of the department from 1924 to 1954; Dr. Henry R. Robinson, who became a lecturer in the department of obstetrics and gynecology in 1917, clinical professor in 1933, and since that time has served as part-time professor; and Eugene L. Porter, Ph.D., professor of physiology, who, after holding appointments in the medical schools of the University of Pennsylvania and the Western Reserve University, was appointed professor of physiology at the University of Texas Medical Branch School of Medicine in 1924. Dr. Porter will continue as an active member of the department of physiology.

VIRGINIA

Annual Meeting in Roanoke.—The 112th annual meeting of the Medical Society of Virginia will be held Oct. 4-7 at the Hotel Roanoke, Roanoke. Papers to be presented by guest speakers are as follows:

Diagnosis and Treatment of the Problems of Secondary Amenorrhea, Dr. Lee Buxton, New Haven, Conn.
The Retarded Child—What Can the Physician Do?, Dr. Courtland H. Davis Jr., Winston-Salem, N. C.
Subtle Signs and Symptoms of Congestive Heart Failure, Dr. Bruce Logue, Atlanta, Ga.
Some Considerations in Making Psychiatric Referral, Dr. Robert H. Felix, Bethesda, Md.
Current Concepts in the Surgical Management of Aortic Valvular Disease, Dr. William H. Muller Jr., Charlottesville.
Newer Aspects of Diagnosis and Treatment of Endocrine Diseases, Dr. David M. Hume, Richmond, Va.

A panel discussion, "Social Security," will be moderated by Dr. W. Linwood Ball, Richmond, and will include as guest speakers Mr. Mauric D. Duberry, regional representative of the Bureau of Old Age and Survivors Insurance, Charlottesville, and Dr. L. Howard Schriver, Cincinnati. The annual banquet will be held Oct. 5, 7:30 p. m. Chairman of the local committee on arrangements is Dr. Robert S. Hutcheson.

WEST VIRGINIA

Seminar on Prematurity and Infections.—A seminar, "Prematurity and Infections in Infants and Newborn," sponsored by the West Virginia State Department of Health, Division of Maternal and Child Health, will be held in the auditorium at St. Mary's Hospital School of Nursing at Clarksburg Nov. 19. The program includes the following:

Infections of the Infants and Newborns, Dr. Heinz F. Eichenwald, New York City.
Obstetrical Aspects of Prematurity, Dr. Anthony Ruppersberg Jr., Columbus, Ohio.
Recent Advances in the Treatment of the Premature, Dr. Charles H. Bauer, New York City.

The one-day meeting is being arranged by Dr. William W. Currence, of Charleston, pediatric consultant to the Division of Maternal and Child Health, in cooperation with Dr. Frederick H. Dobbs, Charleston, consultant in obstetrics. A discussion period will follow each paper.

WISCONSIN

Internists Meet in Marshfield.—The featured speakers at the Wisconsin Society of Internal Medicine's annual business meeting and scientific program, Saturday, Sept. 19, at Marshfield, will be Dr. Michael L. Furculow, medical director and chief of the Kansas City Field Station of the Communicable Disease Center, and Dr. Herbet H. Berger, of Staten Island, N. Y., who will present "The Internist and Third Party Payment." The scientific program will include a "Symposium on Fungus

Diseases of the Chest." Dr. J. LeRoy Sims, president of the Wisconsin Society of Internal Medicine, will extend the opening session welcome and preside at the business meeting. A special program of social activities is scheduled for the ladies and members are urged to bring their wives. The program is open to all physicians, residents, and interns. There is no registration fee.

GENERAL

Midwest Meeting of Physicians.—The American College of Physicians will hold its Midwest Regional Meeting for Illinois, Indiana, Iowa, Minnesota, and Wisconsin Saturday, Sept. 26, with headquarters at the Marott Hotel, Indianapolis. Twenty-two papers are scheduled for presentation. A women's program is arranged, and the following governors will be present: Dr. Kenneth G. Kohlstaedt, Indianapolis, governor for Indiana; Dr. Thomas D. Masters, Springfield, governor for Southern Illinois; Dr. Frederick W. Madison, Milwaukee, governor for Wisconsin; Dr. Hugh R. Butt, Rochester, governor for Minnesota; Dr. Willis M. Fowler, Iowa City, governor for Iowa. At the evening session, Dr. Howard P. Lewis, Portland, Ore., president of the college, will present an address.

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Meeting on Medical Clinics.—The 10th annual session of the American Association of Medical Clinics will be held at the Sheraton–Blackstone Hotel, Chicago, Sept. 24-26. Three concurrent workshops are planned for the morning of Sept. 25: Clinical–Hospital Relationships; Medical Records; and How to Make the Best Use of Available Clinic Office Space. Dr. Joseph W. St. Geme, Los Angeles, will present the presidential address at 2:00 p. m. that afternoon. Luncheon speakers will be Philip Hauser, Ph.D., presenting, "Urban, Suburban, and Rural Population Trends: Implications for Medical Practice," and Mr. Elliot L. Richardson, Assistant Secretary, Health, Education, and Welfare, Washington, D. C., presenting "Federal Responsibilities in the Field of Health." Panel discussions are planned under the following titles: How Can Group Practice Aid in the Care of the Aged and Architecture and Financing of Clinic Structures. Technical exhibits are planned. For information write Dr. Joseph B. Davis, 134 N. Washington St., Marion, Ind.

Symposium on Developments in Hematology.—On Thursday, Oct. 8, the University of Buffalo School of Medicine will present a symposium on important developments in hematology in Capen Hall, Buffalo, N. Y. Papers to be presented are as follows:

Present Concepts of Bone Marrow Transplantation, Dr. William Dameshek, Boston.
Immunologic Problems in Hematology, Dr. Ernest Witebsky, Buffalo.
Basic Developments in Iron Metabolism, Col. William H. Crosby Jr., M. C., Washington, D. C.
Lessons from the Red Cell, Dr. Lawrence E. Young, Rochester, N. Y.
New Aspects of Hemoglobin Genetics, Dr. Arno G. Motulsky, Seattle.
The Fine Structure of Developing Megakaryocytes, Dr. Oliver P. Jones, Buffalo.
Coagulation, Dr. Leondro M. Tocantins, Philadelphia.
Basic Developments in Chemotherapy, Dr. Charles G. Zubrod, Bethesda, Md.

Dr. Marvin L. Bloom, Dr. John H. Talbott, and Dr. Witebsky will serve as general chairmen. Open forums will follow the morning and afternoon scientific sessions. Registration fee is $5 (checks payable to the University of Buffalo). For registration and information write the Department of Postgraduate Education, University of Buffalo School of Medicine, 3435 Main St., Buffalo 14, N. Y.

District Meeting of Obstetricians and Gynecologists.—District VII of the American College of Obstetricians and Gynecologists will hold its seventh annual meeting in the Chase–Park Plaza Hotels, St. Louis, Sept. 17-19. The district covers Alabama, Arkansas, Kansas, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, Texas, and Canal Zone. The St. Louis Gynecological Society will be host. The scientific program will consist of 21 papers, 10 round-table luncheons, two case reports, and two scientific motion pictures. The annual banquet will be held the evening of Sept. 18. The round tables will cover psychosomatic gynecology, induction of labor, exfoliative cytology, prenatal problems, gynecologic endocrinology, residency training, new concepts of endometriosis, the question of oophorectomy at 45, hypnosis in labor, and the choice of therapy in genital cancer. Management of cardiac arrest and the construction of an artificial vagina will be shown in motion pictures. Dr. Eugene G. Hamilton, St. Louis, is chairman of the local arrangements committee. Dr. Buford Word, Birmingham, is district chairman; Dr. William P. Devereux, Dallas, vice-chairman; and Dr. William T. Black Jr., Memphis, secretary-treasurer. Information may be had by writing to Mr. Donald F. Richardson, the American College of Obstetricians and Gynecologists, Box 749, Chicago 90.

Surgeons Meet in Chicago.—Surgeons from many parts of the free world will present scientific papers at the 24th annual congress of the North American Federation, International College of Surgeons, to be held at the Palmer House, Chicago, Sept. 13-17. Among the special features will be military reports on medical operations and research in climatic and environmental extremes, to be presented by six Navy medical officers. Prof. Dr. Andre Thomas, of the Faculty of Sciences, the Sorbonne, Paris, inventor of an artificial pulmonary membrane, will give a demonstration of progress in artificial cardiopulmonary circulation and the physiological and surgical results obtained from the use of his instru-

ment. The annual Acuff Memorial Lecture will be presented by Prof. Dr. Sten Friberg, professor of surgery, University of Stockholm, Sweden. Senator Joseph Lister Hill (Ala.) and Senator Hubert H. Humphrey (Minn.) will be speakers at nonscientific events. A special program to which lay leaders will be invited also is planned. The annual banquet will be given on Wednesday evening. The North American Federation comprises the United States, Canada, Mexico, Cuba, Haiti, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama. Information may be had by writing to the Secretariat, International College of Surgeons, 1516 Lake Shore Drive, Chicago 10.

Prevalence of Poliomyelitis.—According to the National Office of Vital Statistics, the following number of reported cases of poliomyelitis occurred in the United States, its territories and possessions in the weeks ended as indicated:

Area	Aug. 15, 1959 Paralytic Type	Aug. 15, 1959 Total Cases	Aug. 16 1958 Total
New England States			
Maine	..	..	..
New Hampshire	..	1	1
Vermont	..	..	..
Massachusetts	4	8	1
Rhode Island	..	..	1
Connecticut	9	18	2
Middle Atlantic States			
New York	14	23	19
New Jersey	1	3	17
Pennsylvania	3	6	6
East North Central States			
Ohio	6	16	14
Indiana	3	7	3
Illinois	10	19	7
Michigan	8	31	42
Wisconsin	1	2	3
West North Central States			
Minnesota	12	15	1
Iowa	11	25	3
Missouri	21	30	5
North Dakota	..	..	2
South Dakota	..	..	..
Nebraska	4	14	..
Kansas	6	19	1
South Atlantic States			
Delaware	..	..	4
Maryland	4	4	1
District of Columbia	2	2	..
Virginia	13	19	7
West Virginia	2	4	5
North Carolina	14	15	12
South Carolina	1	1	..
Georgia	12	18	3
Florida	8	9	1
East South Central States			
Kentucky	4	4	1
Tennessee	19	30	7
Alabama	19	26	6
Mississippi	..	2	9
West South Central States			
Arkansas	16	18	..
Louisiana	7	10	3
Oklahoma	3	6	1
Texas	21	34	22
Mountain States			
Montana	..	..	5
Idaho	..	..	1
Wyoming	..	..	..
Colorado	..	..	1
New Mexico	1	2	..
Arizona	1	2	1
Utah	..	..	1
Nevada	..	..	..
Pacific States			
Washington	..	9	1
Oregon	6	7	1
California	13	15	7
Alaska	..	2	..
Hawaii	..	..	5
Territories and Possessions			
Puerto Rico	..	..	..
Total	279	476	233

Physicians Meet in Tulsa.—The American College of Physicians will hold a regional meeting for Arkansas and Oklahoma Sept. 19 at the Mayo Hotel, Tulsa, Okla. Dr. Bert F. Keltz, governor for Oklahoma, will open the program with an address. Papers including invited authors are as follows:

A Strange Case of Hyperglycemia, Dr. Benjamin O. Price, Little Rock, Ark.

Some Preliminary Investigations in the Use of Large Intermittent Doses of Anti-Folics in the management of Human Neoplastic Diseases, Dr. Paul T. Condit, Oklahoma City.

Toxicity of Tranquilizers, Dr. Mervin L. Clark, Norman, Okla.

Pseudohypoparathyroidism, Dr. James L. Stecher, Little Rock, Ark.

Experimental Pulmonary Hypertension and Induced Clotting. Defect in Dogs, Dr. Robert M. Bird, Oklahoma City.

The Use of Intravenous Urea in the Treatment of Edema, Dr. William O. Smith, Oklahoma City.

Antibodies to Human Lung in Sera of Patients with Pulmonary Disease, Dr. Allen R. Hennes, Oklahoma City.

The Effect of Opiates on the Serum Transaminase, Dr. Walter L. Honska Jr., Oklahoma City.

A panel discussion, "Some Diagnostic Procedures in Selection of Patients for Cardia Surgery," will be moderated by Dr. John J. Donnell, Oklahoma City.

LATIN AMERICA

Medical Education Group in Argentina.—The Argentine Society of Medical Education has been formed for the study of problems in medical education, with special and immediate emphasis on the following:

The establishment of postgraduate residency systems in federal, municipal, and private hospitals.

Modernization of the hospital system.

Creation of specialty accreditation and recognition in the various medical fields, i. e., Argentine Boards of Internal Medicine, Boards of Surgery, etc.

Collaboration with medical, scientific, and educational organizations with similar objectives.

The executive committee is composed of the following persons: Dr. Ezequiel Holmberg, president; Dr. Jorge Manrique, secretary; and Dr. Agustin Alvarez, Dr. Jorge Firmat, and Dr. Carlos Gianantonio, members. All correspondence should be directed to Dr. Jorge Manrique, Secretary, Guemes 2926, Buenos Aires, Argentina.

FOREIGN

Rural Pediatrics Study in Nigeria.—The University College, Ibadan, Nigeria, reportedly the only institution on the West Coast of Africa conducting research and training on indigenous medical problems, is initiating a pediatrics study in rural areas. The Rockefeller Foundation is giving about $108,870 in support of the program over a three-year period. Dr. W. R. F. Collis, head of pediatrics at the college, will direct a small group in a study of African diseases affecting children in the Ilesha–Imeis region. The study will be aimed at discovering the incidence of various diseases among

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children, their relative importance, and their natural history in village life. Special attention will be given to nutrition, since dietary deficiencies are thought to be responsible for a large proportion of illnesses and deaths in young children. A field station will also be set up where pediatrics students from the college can receive training in providing sanitation, health education, and ambulatory care at the village level. The twofold program will provide factual information and new opportunities for training that are needed in an area of West Africa whose population is over 45 million.

DEATHS IN OTHER COUNTRIES

Dr. Oscar Vogt.—The director of the Institute for Brain Research in Neustadt, Germany, Dr. Oscar Vogt died Aug. 3, in the Freisburg University Surgical Clinic. His age was 90. Dr. Vogt formerly was director of the Kaiser Wilhelm Institute for brain research, in the Berlin suburb of Buch. At the Neustadt Institute, which he operated with his physician wife, Cecile, Dr. Vogt reportedly amassed one of the largest collections of brains in the world. While head of the Kaiser Wilhelm Institute he went to Moscow to help the Russians set up a similar institute for brain research.

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EXAMINATIONS AND LICENSURE

MEDICAL SPECIALTY BOARDS

AMERICAN BOARD OF ANESTHESIOLOGY: *Written.* Various locations, July 8. Final date for filing application is January 8. *Oral.* Miami Beach, April 25-30. Applications already on file. Sec., Dr. Forrest E. Leffingwell, 217 Farmington Ave., Hartford 5, Conn.

AMERICAN BOARD OF DERMATOLOGY: *Written.* Several Cities, Oct. 5. *Oral.* Oklahoma City, Jan. 15-18, 1960. The final date for filing all applications was July 1, 1959. Sec., Dr. Beatrice M. Kesten, One Haven Ave., New York 32.

AMERICAN BOARD OF INTERNAL MEDICINE: *1959 Schedule—Written,* Oct. 19. Final date for filing application was May 1. *Oral.* For candidates on the East Coast, Nov. 6-7, 9-10. Final date for filing application was March 1. *Oral.* Philadelphia, March 11-12. Final date for filing application is January 15. Sec.-Treas., Dr. William A. Werrell, One West Main St., Madison 3, Wis.

AMERICAN BOARD OF NEUROLOGICAL SURGERY: Examination given twice annually, in the spring and fall. In order to be eligible a candidate must have his application filed at least six months before the examination time. New Haven, Nov. 14-16. Sec., Dr. Donald D. Matson, 300 Longwood Ave., Boston, Mass.

AMERICAN BOARD OF OBSTETRICS AND GYNECOLOGY: *Part I, Written.* Chicago, January 16. *Part II, Oral.* Chicago, April 11-16. Final date for filing application was August 1. Sec., Dr. Robert L. Faulkner, 2105 Adelbert Road, Cleveland 6.

AMERICAN BOARD OF OPHTHALMOLOGY: *Oral.* St. Louis, Oct. 6-10. *Written.* January 1960 in various cities. Applications for the 1960 written examination must be filed before July 1. *Oral.* 1960, San Francisco, May; Chicago, October. Sec., Dr. Merrill J. King, Box 236, Cape Cottage Branch, Portland, Maine.

AMERICAN BOARD OF ORTHOPAEDIC SURGERY: *Part II.* Chicago. Jan. 19-21, 1960. The deadline for the receipt of application was Aug. 15. Sec., Dr. Sam W. Banks, 116 South Michigan Ave., Chicago 3.

AMERICAN BOARD OF OTOLARYNGOLOGY: *Oral.* Chicago, Oct. 5-9. Final date for filing application was April 1. Sec., Dr. Dean M. Lierle, University Hospitals, Iowa City.

AMERICAN BOARD OF PATHOLOGY: New Orleans, Nov. 12-14. Final date for filing application is October 1. Sec., Dr. Edward B. Smith, Indiana University Medical Center, 1100 W. Michigan St., Indianapolis 7.

AMERICAN BOARD OF PATHOLOGY: *Examination in Forensic Pathology.* New Orleans, Nov. 13. Final date for filing application is October 1. Sec., Dr. Edward B. Smith, Indiana University Medical Center, 1100 W. Michigan St., Indianapolis 7.

AMERICAN BOARD OF PEDIATRICS: *Oral.* Chicago, Oct. 9-11. *Written.* January 1960. Exec. Sec., Dr. John McK. Mitchell, 6 Cushman Road, Rosemont, Pa.

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION: *Oral and Written.* New York, June 17-18. Sec., Dr. Earl C. Elkins, Mayo Clinic, Rochester, Minn.

AMERICAN BOARD OF PLASTIC SURGERY: *Oral and Written.* Miami, Fla., Oct. 15-17. Final date for submitting case reports was July 1. *Oral and Written.* Milwaukee, May 1960. Final date for filing application is January 1. Corresponding Secretary, Mrs. Estelle E. Hillerich, 4647 Pershing Ave., St. Louis 8, Mo.

AMERICAN BOARD OF PSYCHIATRY AND NEUROLOGY: Chicago, Oct. 19-20; New York, Dec. 14-15; San Francisco, Mar. 14-15, 1960. Training credit for full time psychiatric and/or neurologic assignment in unapproved military programs or services between the dates of Jan. 1, 1950 and Jan. 1, 1954 was terminated on Jan. 1, 1959. Sec., Dr. David A. Boyd, 102-110 Second Ave. S. W., Rochester, Minn.

AMERICAN BOARD OF RADIOLOGY: *Examination.* Washington, Dec. 6-9. Deadline for filing application was July 1. Candidates examined in Diagnostic Roentgenology may expect to be examined in Physics. Obligatory examination in Nuclear Medicine has been postponed until after June 30, 1962 for those candidates being examined in Radiology or Therapeutic Radiology. Until that time the examination in Nuclear Medicine will be optional for those who wish to be examined in Radiology or Therapeutic Radiology. *Examination.* Cincinnati, Spring 1960. Deadline for filing applications is Jan. 1. A special examination in Nuclear Medicine (for those diplomates in Radiology or Therapeutic Radiology) will be offered provided there are sufficient applications. Sec., Dr. H. Dabney Kerr, Kahler Hotel Bldg., Rochester, Minn.

AMERICAN BOARD OF SURGERY: *Written* examinations (Part I) will be held on December 2, 1959 at various centers to be announced later. Closing date for filing applications was August 1. Those completing training requirements after September 30 cannot be considered for the Part I examination in December of the same year. *Oral examinations (Part II):* Seattle, Sept. 17-18; Baltimore, Oct. 19-20; Cincinnati, Nov. 9-10; Boston, Dec. 14-15; Winston-Salem, No. Car., Jan. 18-19; New York, N. Y., Feb. 15-16; New Orleans, Mar. 14-15; Kansas City, Kans., May 16-17, and Los Angeles, May 19-20. Sec., Dr. John B. Flick, 1617 Pennsylvania Blvd., Philadelphia 3.

AMERICAN BOARD OF UROLOGY: *Written.* Approximately 25 cities throughout the country, December 4, 1959. *Oral-Clinical* and *Examination in Pathology.* Chicago, February 1960. Final date for filing application is Sept. 1, 1959. Sec., Dr. William Niles Wishard, 30 Westwood Rd., Minneapolis 26, Minn.

GOVERNMENT SERVICES

AIR FORCE

Volunteers Selected for Simulated Space Flight.—Volunteer Air Force pilots have been carefully screened and a group selected from which two men will be drawn for the first experiment in the United States in long-term simulated space flight. Lieut. Col. George R. Steinkamp, chief of the department of astroecology for the Air Force's School of Aviation Medicine, said plans are being made to confine two of the volunteers in a space cabin simulator for 30 days. The simulator is a 7-ton device 8 ft. high and 12 ft. long. Despite the physical problems of living in cramped quarters for an extended period, the greatest stresses will probably be psychological. The men who enter the cabin will be completely sealed off from the world to which they have grown so accustomed. Time will weigh heavily on their minds. The familiar day-night cycle will be lost.

The astronauts will breathe and rebreathe the same air and drink and redrink the same water. Urine and all other forms of waste matter are purified by a process which includes chemical treatment, preliminary filtering, superheating, freezing, and final filtering through activated carbon. Feces and other solid wastes like hair and garbage will be dehydrated and burned in an incinerator, and the gases produced will be disposed of with an afterburner. All that will remain will be a small amount of fine ash. Despite the obvious rigors of the experiments, volunteers have been numerous. Although no serious psychological problems are expected, the first two men to take the test may not be speaking to each other when it is over.

The space capsule is provided with heating and cooling elements for temperature control and a humidity control device that can pull moisture from the air and store it along with the water supply. Food for the simulated trip will be nonperishable, so refrigeration is not required, but a heating element will be provided to warm up soup and coffee. The space capsule includes a panel with instruments which record environmental conditions and controls to alter these conditions. Atmospheric controls for the cabin are designed so that either the occupants or researchers at an outside control panel can vary the air pressure, oxygen and carbon dioxide concentrations, temperature, and humidity. Final control is in the hands of the outside monitors. For their daily needs the space travelers will be allotted 2 qt. of water and 3,000 calories of food. They will have 2 cu. ft. of space, about the size of an overnight bag, to store their clothes and about 2 cu. ft. of storage space for personal belongings.

ARMY

Personal.—Brig. Gen. Thomas J. Hartford, M.C., deputy surgeon general, was promoted to the rank of major general at a ceremony held in the surgeon general's office, Washington, D. C. The surgeon general, Major Gen. Leonard D. Heaton, M.C., pinned the new star on General Hartford.

VETERANS ADMINISTRATION

Open-Door Treatment.—The Veterans Administration is changing its mental hospitals into "open-door" treatment communities. Many of the patients live and work at the hospitals and come and go about the hospital grounds and nearby towns, much as they would if they lived in a normal community, while they continue to participate in and receive hospital treatment. This development is in line with the best modern concepts of psychiatry and is doing a great deal to speed the recovery of patients. Open-door mental hospitals have reported fewer patients leaving against medical advice, fewer acts of hostility, and higher discharge rates than closed mental hospitals. The VA open-door policy is backed by an active treatment program involving extensive orientation of the entire staffs of the hospitals and the assistance of volunteers from nearby communities.

Not all patients, however, are able to accept the responsibility of more freedom, and therefore it is necessary for the hospitals to maintain supervision for these patients in closed wards. Granting of the maximum practicable amount of personal freedom is a major factor in rehabilitating psychiatric patients as it gives them an opportunity to learn to make their own decisions and adapt to new situations. Many patients in VA mental hospitals now choose their own clothing, get their haircuts independently at the hospital barber shops, and select their own recreation from a wide variety offered by the hospitals. Many also are able to participate in work-therapy assignments and make occasional visits to their homes as a preparation for return to life outside the hospital. The open-door policy is an extension of the practice, long followed by the VA, of enabling mental patients to keep in touch with their families and friends and live as normal lives as possible. To encourage mental patients to lead normal lives, some 20,000 of them are treated each month at VA mental hygiene clinics instead of being hospitalized and more than 65 VA general medical and surgical hospitals have sections for short-term treatment of psychiatric patients.

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DEATHS

Abbott, George Knapp, Riverside, Calif.; born in Spirit Lake, Iowa, Jan. 4, 1880; American Medical Missionary College, Battle Creek, Mich., and Chicago, 1903; fellow of the American College of Surgeons; formerly dean and professor of the practice of medicine, College of Medical Evangelists in Loma Linda and Los Angeles; served as medical superintendent of the Glendale (Calif.) Sanitarium, physician in charge of the Loma Linda (Calif.) Sanitarium, where he was later medical superintendent, medical superintendent of the St. Helena Sanitarium and Hospital in Sanitarium, where for many years he was a surgeon, and medical superintendent of the Washington (D. C.) Sanitarium and Hospital; author of many books; died in Arlington July 2, aged 79.

Barash, Louis Ⓜ New York City; Columbia University College of Physicians and Surgeons, New York City, 1920; specialist certified by the American Board of Pediatrics, Inc.; member of the American Academy of Pediatrics; associated with the Beth Israel Hospital; died July 7, aged 63.

Bedford, Edgar William Ⓜ Minneapolis; Rush Medical College, Chicago, 1914; veteran of World War I; on the staff of the Doctors Memorial Hospital; died in San Francisco June 23, aged 71.

Black, Burton Alexander Ⓜ Grove City, Pa.; Medical Department of the Western University of Pennsylvania, Pittsburgh, 1905; at one time associated with the State Institution for the Feebleminded of Western Pennsylvania in Polk; past-president of the Grove City Rotary Club; on the honorary staff of the Grove City Hospital, where he died June 16, aged 83.

Bordelon, William Paul Ⓜ Lake Charles, La.; Tulane University School of Medicine, New Orleans, 1916; died June 28, aged 66.

Brittain, Elmore Glenn Ⓜ Clearwater Beach, Fla.; Baylor University College of Medicine, Dallas, 1917; veteran of World Wars I and II; formerly practiced in Bound Brook, N. J.; fellow of the American College of Surgeons; served on the staff of the Somerset Hospital in Somerville, N. J.; died June 27, aged 63.

Brooks, Herbert Thomas Ⓜ Alhambra, Calif.; University of Nashville (Tenn.) Medical Department, 1906; fellow of the American College of Physicians; formerly dean and professor of pathology at the University of Tennessee College of Medicine in Memphis; from 1922 to 1924 professor of clinical medicine at the College of Medical Evangelists in Loma Linda and Los Angeles; on the staff of the Huntington Memorial Hospital in Pasadena and the Garfield Hospital in Monterey Park; died June 29, aged 77.

Brush, Edward Lewis Ⓜ Norfolk, Neb.; University of Nebraska College of Medicine, Omaha, 1906; fellow of the American College of Surgeons; past-president of the Madison County Medical Society and the Fourth District Medical Society; served as secretary of the Elkhorn Valley Medical Society and as past-president of the Nebraska State Medical Association; died in the Clarkson Memorial Hospital, Omaha, June 16, aged 80.

Bryant, Melton Daniel, Savannah, Ga.; Meharry Medical College, Nashville, Tenn., 1921; medical superintendent and a member of the board of directors of the Charity Hospital; vice-president and medical examiner of Guaranty Life Insurance Company; died June 22, aged 66.

Carter, John Nicholas, Ottawa, Kan.; Northwestern University Medical School, Chicago, 1929; past-president of the Anderson County Medical Society and health officer of Anderson County; served on the staff of the Anderson County Hospital in Garnett and the Ransom Memorial Hospital; died in Garnett June 26, aged 59.

Clark, Samuel Micajah, Woodbine, Iowa; St. Louis College of Physicians and Surgeons, 1903; served as mayor and councilman; died in Harlan June 23, aged 80.

Cline, George Willis, San Jose, Calif.; Stanford University School of Medicine, San Francisco, 1916; veteran of World War I; a director of the San Jose State College Alumni Association and in 1958 was elected president of its Golden Grads; died June 30, aged 74.

Connell, John Timon Ⓜ Flint, Mich.; University of Michigan Medical School, Ann Arbor, 1918; in 1956 elected president of the Flint Hospital Council; specialist certified by the American Board of Internal Medicine; member of the American Academy of General Practice; past-president of the Genesee County Medical Society; served on the faculty of his alma mater; in 1916-1917 instructor in bacteriology at the Leland–Stanford University at Stanford, Calif.; associated with Hurley Hospital, McLaren General Hospital, and St. Joseph Hospital, where he died June 16, aged 70.

Cross, Denzil D. Ⓜ Lubbock, Texas; Northwestern University Medical School, Chicago, 1920; fellow of the American College of Surgeons; past-president

Ⓜ Indicates Member of the American Medical Association.

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of the Panhandle Medical Society; for many years on the staff of the West Texas Hospital; died June 30, aged 67.

Cunningham, Lester Wallace Ⓜ Mandarin, Fla.; Medico-Chirurgical College of Philadelphia, 1904; specialist certified by the American Board of Radiology; member of the American Roentgen Ray Society; served as president of the Florida Radiological Society; died in the Baptist Hospital, Jacksonville, June 20, aged 76.

Cutliffe, William Ogburn Ⓜ Captain, U. S. Army, retired, Seattle; University of Virginia Department of Medicine, Charlottesville, 1888; veteran of the Spanish-American War and World War I; retired March 15, 1927; died in the Veterans Administration Hospital June 23, aged 92.

Dewein, Edward George Ⓜ Freeburg, Ill.; Medical College of Virginia, Richmond, 1929; member of the American Academy of General Practice; past-president of St. Clair County Medical Society; for 24 years served as a member of the Freeburg Elementary School Board; past-president of the Chamber of Commerce and Rotary Club; on the staffs of Memorial Hospital and St. Elizabeth Hospital in Belleville, where he died June 29, aged 55.

Diggs, Nicholas Alfred G. Ⓜ Chicago; Meharry Medical College, Nashville, Tenn., 1916; since 1949 physician of the Illinois State Athletic Commission; attending honorary senior surgeon at Provident Hospital, where he died June 25, aged 70.

Downey, Denis Sebastian Ⓜ Chickasha, Okla.; University of Louisville (Ky.) Medical Department, 1908; president of the Chickasha Federal Savings and Loan, and a director of the Oklahoma National Bank; died in Oklahoma City June 28, aged 80.

Flood, Anthony James, Watertown, N. Y.; Queen's University Faculty of Medicine, Kingston, Ont., Canada, 1914; formerly medical director of the city's school system; associated with the Mercy Hospital and the House of the Good Samaritan, where he died June 30, aged 73.

Geyer, George Henry, San Antonio, Texas; University of Texas School of Medicine, Galveston, 1928; died June 4, aged 53.

Gilman, Robert Broff, Cleveland; Harvard Medical School, Boston, 1958; served an internship at the Peter Bent Brigham Hospital in Boston; died June 26, aged 27.

Griffith, Harry Milton Ⓜ Columbia, Mo.; University of Kansas School of Medicine, Kansas City, 1928; veteran of World Wars I and II; formerly practiced in Richmond, where he was coroner of Ray County and president of the board of education; served as coroner of Boone County; on the staff of the Boone County Hospital; died June 26, aged 60.

Griswold, Ross Williams Ⓜ Litchfield, Ill.; St. Louis University School of Medicine, 1911; fellow of the American College of Surgeons; served overseas during World War I; secretary of the Montgomery County Medical Society; associated with St. Francis Hospital, where he died June 29, aged 70.

Hall, Luther B., Newbern, Tenn.; University of Nashville Medical Department, 1904; died June 23, aged 81.

Heflin, Ernest Lee Ⓜ Louisville, Ky.; born in 1874; Jefferson Medical College of Philadelphia, 1897; Hospital College of Medicine, Louisville, 1898; member of the American Academy of General Practice; past-president of the Jefferson County Medical Society; formerly vice-president of the Southern Medical Association and the Kentucky State Medical Association; served on the faculty of the University of Louisville School of Medicine and the University of Louisville School of Dentistry; member of the staffs of the St. Joseph Infirmary and Kentucky Baptist Hospital, where he died June 19, aged 84.

Heller, James Beyel Ⓜ Pottsville, Pa.; University of Pennsylvania School of Medicine, Philadelphia, 1910; past-president of the Schuylkill County Medical Society; in 1939 appointed medical director of Schuylkill County; fellow of the American College of Surgeons; veteran of World War I; chief surgeon and past-president of the staff at Pottsville Hospital; died June 17, aged 72.

Hogan, Charles Henry Jr., Salem, Mass.; Tufts College Medical School, Boston, 1921; school physician; served on the staff of the Salem Hospital; died June 24, aged 63.

Holcomb, George Whitfield, Birmingham, Ala.; University of Tennessee College of Medicine, Memphis, 1914; served in France during World War I; died in the University Hospital June 26, aged 70.

Holt, Norma Ware Ⓜ Macon, Ga.; Duke University School of Medicine, Durham, N. C., 1947; interned at Children's Hospital in Boston and Duke Hospital in Durham, N. C.; served a residency in pathology at the North Carolina Memorial Hospital in Chapel Hill, N. C.; certified by the National Board of Medical Examiners; on the staff of the Macon General Hospital; died June 25, aged 35.

Hudkins, B. I., Wolf Summit, W. Va.; Medical College of Virginia, Richmond, 1898; associated with St. Mary's Hospital in Clarksburg, where he died June 24, aged 88.

Hulse, Roy Albert Ⓜ Burlington, Iowa; University of Louisville (Ky.) School of Medicine, 1939; interned at the Charity Hospital in New Orleans; served a residency at the Louisville City Hospital in Louisville, Ky., New York Post-Graduate Med-

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ical School and Hospital in New York City, and the Presbyterian Hospital, Olmsted Memorial in Los Angeles; associated with Burlington and Mercy hospitals; died June 29, aged 48.

Ingmire, Bernard Edmund Ⓜ Plain City, Ohio; Ohio State University College of Medicine, Columbus, 1930; member of the American Academy of General Practice; past-president of the Union County Medical Society; died in the Memorial Hospital, Marysville, June 26, aged 56.

Jordan, Henry Dowling Ⓜ Allentown, Pa.; Medico-Chirurgical College of Philadelphia, 1902; fellow of the International College of Surgeons and the American College of Surgeons; for many years associated with the Allentown General Hospital and the Sacred Heart Hospital, where he was one of the founders; died June 24, aged 80.

Scheibe, Alphons Ⓜ New York City; Ludwig–Maximilians–Universität Medizinische Fakultät, München, Bavaria, Germany, 1924; specialist certified by the American Board of Psychiatry and Neurology, Inc.; member of the American Psychiatric Association; veteran of World War II; died while vacationing in Israel June 7, aged 60.

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Shaw, Dudley John Ⓜ Martinsburg, W. Va.; Western Reserve University School of Medicine, Cleveland, 1933; served a term as president of the Eastern Panhandle Medical Society; veteran of World War II; served as president of the Rotary Club and the Civic Music Association; died June 18, aged 52.

Slater, Sidney Alexander Ⓜ Worthington, Minn.; born in Enfield, Va., Aug. 26, 1884; University College of Medicine, Richmond, 1909; past-president of the Minnesota Public Health Association, Sioux Valley Medical Society, Minnesota Tuberculosis and Health Association, Southwestern Minnesota Medical Association, Southern Minnesota Medical Association, Mississippi Valley Trudeau Society, and the Minnesota Trudeau Society; for many years a member of the board of the National Tuberculosis Association; member of the American College of Chest Physicians and founder of the Minnesota Chapter; member of the American Trudeau Society; fellow of the American College of Physicians; in 1957 the University of Richmond awarded him a Golden Legion Certificate of Merit "in recognition of 50 years of service to the university since his graduation in 1907," and the Minnesota Medical Association, of which he was formerly vice-president, presented him with a citation of appreciation for "pioneer service in tuberculosis control"; one of the founders of the Worthington Kiwanis Club and its third president; lieutenant governor of the Southwestern Minnesota division of Kiwanis in 1937; medical director of the Grandview Sanatorium at Oil City, Pa., from 1913 to 1919, when he became medical director of the Southwestern Minnesota Sanatorium; served as associate editor of the *Journal–Lancet;* died June 12, aged 74.

Smith, Clyde S. Ⓜ Rossville, Kan.; Keokuk (Iowa) Medical College, College of Physicians and Surgeons, 1905; on the staff of St. Francis Hospital in Topeka; died June 15, aged 77.

Somers, Charles Joseph Ⓜ Lansing, Ill.; Chicago Medical School, 1936; member of the American Academy of General Practice; veteran of World War I; on the staff of St. James Hospital in Chicago Heights; died in the Veterans Administration Research Hospital in Chicago June 24, aged 66.

Stahl, William Fred, Corvallis, Ore.; University of Missouri School of Medicine, Columbia, 1903; College of Physicians and Surgeons, Los Angeles, 1905; formerly practiced in Los Angeles, where he was associated with the Cedars of Lebanon Hospital; died June 9, aged 80.

Stewart, Margaret Ross, Healdsburg, Calif.; Hahnemann Medical College of the Pacific, San Francisco, 1900; Woman's Medical College of Pennsylvania, Philadelphia, 1906; died in St. Helena June 1, aged 84.

Taylor, Byrne Evans Ⓜ Orlando, Fla.; College of Medical Evangelists, Loma Linda and Los Angeles, 1932; certified by the National Board of Medical Examiners; veteran of World War II; on the staff of the Florida Sanitarium and Hospital; died in Daytona Beach June 14, aged 53.

Vaught, Walter Kelly, Spring Arbor, Mich.; St. Louis University School of Medicine, 1916; for many years practiced in Detroit, where he was on the staffs of the Grace and Florence Crittenton hospitals; served on the staff of the Ardmore Hospital at Ferndale; died in Mercy Hospital, Jackson, June 5, aged 73.

Weinberg, Charles Berenda, New York City; Jefferson Medical College, Philadelphia, 1909; for many years associated with the New York Post-Graduate Medical School and Hospital; served as resident physician at the Governor Clinton Hotel; died in St. Barnabas Hospital June 9, aged 74.

Wilson, I. Ripon Sr. Ⓜ Charleston, S. C.; Medical College of South Carolina, Charleston, 1913; also a graduate in pharmacy; past-president of the South Carolina Medical Association; at one time mayor pro tem of Charleston; died June 14, aged 83.

Wyker, Arthur William Ⓜ Riviera Beach, Fla.; University of Vermont College of Medicine, Burlington, 1919; fellow of the American College of Surgeons; practiced in Bloomfield, N. J.; served on the staffs of St. Mary's Hospital in Orange, N. J., St. Vincent's Hospital and the Mountainside Hospital in Montclair, N. J., where he died June 21, aged 65.

FOREIGN LETTERS

GERMANY

Splenic Homogenate.—H. J. Thom of Heidelberg University (*Strahlentherapie* **109**:47, 1959) gave inbred rats a whole-body irradiation of 800 rep and treated them with two injections of 0.5 ml. of a homogenate of spleen cells from healthy animals of the same breed. The first injection was given intravenously right after the irradiation. The second injection was given intraperitoneally three days after irradiation. As compared with the control animals the regeneration of the marrow in the treated animals was more rapid. The initial phase of damage was not changed. By the third day after irradiation the first signs of regeneration were observed. There was complete restitution after 14 days as compared with 21 days in the untreated animals. The increased regeneration of the marrow by splenic homogenate was most noticeable in the erythropoiesis, less marked in the myelopoiesis.

Pneumonectomy for Tuberculosis.—Kraan and Eerland (*Ztschr. Beitr. Klin. Tuberk.* **119**:499, 1959) studied a series of 1,496 pulmonary resections in tuberculous patients. During the period covered by the report (1945-1958) the proportion of pneumonectomies decreased to 1.4% and of lobectomies to 14.4%. The number of segmental resections increased to 84.2%. Of the patients admitted after 1950 more than 55% had cavities when first seen. More than 70% of the patients discharged recovered with bed rest and medicinal treatment alone. Resection is now considered indicated if the foci remain unchanged after 7 to 10 months of strict bed rest and drug treatment, the sputum is positive, and resistance of the tubercle bacilli is manifest or imminent. Evaluation of a series of 1,316 patients operated on by Jan. 1, 1959, revealed a primary death rate after pneumonectomy of 8%, after segmental resection of 0.25%, and after lobectomy and segmental resection together of 0.6%. The late mortality was 3.2%. Bronchopleural fistula and empyema ranked first among the causes of death.

Measures for preparatory and follow-up treatment have been developed further, and among them should be specially mentioned combined treatment with para-aminosalicylic acid (PAS) plus streptomycin (SM) plus isoniazid (INH), SM plus INH, or PAS plus INH. In order to preclude the danger of development of resistance, the right time for removal of the main focus should not be missed. Bronchial fistulas occurred in 4%, appearing during the first half-year. Relapses occurred in 74 (5.7%). The sputum became negative in 97.6%, and 89.6% regained full ability to work. Of 637 patients whose progress was followed for more than five years 98.1% had negative sputum and 93.8% were fully able to work. Thoracoplasty was resorted to for pretreatment in isolated cases. Intrapleural and extrapleural pneumothorax are rarely indicated and phrenic nerve operations have become obsolete.

Dexamethasone for Arthritis.—Miehlke and Thüringen (*Ztschr. Rheumaforsch.* **18**:131, 1959) treated a series of 19 patients who had acute rheumatism, chronic rheumatoid arthritis, subacute polyarthritis, spondylitis ankylopoietica, erythema exudativum multiforme, lupus erythematosus, and bronchial asthma with dexamethasone and compared the results with those of treatment with prednisone. Excellent results were obtained in six patients with chronic rheumatoid arthritis, acute rheumatism, and subacute polyarthritis and satisfactory results in another six who had rheumatoid arthritis. The sedimentation rate was markedly reduced with dexamethasone treatment in 16 patients. Potassium levels were lowered or returned to normal. A slight increase in blood sugar level was observed in one. Glucose tolerance tests during dexamethasone treatment revealed an abnormally low tolerance in two patients and a normal curve in five. Dexamethasone is six to eight times as effective as prednisone.

Chloroquine for Paragonimiasis.—A. A. Buck and co-workers (*Ztschr. Tropenmed. u. Parasitol.* **2**:310, 1958) treated a series of 116 Korean patients who had paragonimiasis with chloroquine diphosphate. The average daily dose, 0.75 Gm. for adults and 0.5 Gm. for children under 15 years of age, was given intramuscularly, orally, as an aerosol, or intrapleurally. Disappearance of the ova was apparent after giving 5 to 40 Gm. Patients who did not respond to this amount were not benefited by larger doses. With a total dose of 40 to 120 Gm., stools and sputum remained free of eggs in 23.2% for at least three months and in 12.2% for at least six months. Roentgenography confirmed regression of infiltrative pulmonary foci in 30% of the patients who had received a total of at least 35 Gm. of chloroquine. Patients with chronic pulmonary disease were resistant to the treatment. Roentgenologically visible improvement was most frequent (80%) in those whose results of sputum and stool examinations remained negative for six months. Among

The items in these letters are contributed by regular correspondents in the various foreign countries.

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those with extrapulmonary forms pleural empyema responded best, and a patient with renal paragonimiasis showed good results; but those with cerebral involvement showed no improvement and even reacted with epileptiform fits, necessitating withdrawal of the drug. Unless the patients had concurrent hepatic damage, kidney disease, or hypertension, the preparation did not give rise to undesirable side-effects, even in doses of more than 100 Gm.

INDIA

Aortic Regurgitation.—Betts and Saini (*Indian Journal of Surgery*, vol. 21, April, 1959) treated four patients who had severe aortic regurgitation of rheumatic origin by inserting Hufnagel valves. Since the circulation must be occluded temporarily during insertion of the valve, the authors used hypothermia. The operation was started when the rectal temperature had been reduced to 95 F (35 C); the temperature went down to about 93 F (33.3 C) by the time the aorta was occluded. It took about 18 minutes to complete insertion of the valve in the aorta, but in two instances the total time of occlusion was 55 minutes. In spite of such a prolonged period of occlusion of circulation no damage to the cord or kidneys was observed in these patients. Hypothermia was therefore thought to be a useful adjunct. The added risk was negligible, since the hypothermia used here was of only moderate degree. All the patients responded to the operation with a prompt return of the diastolic pressure in the lower extremities and some lowering of the systolic blood pressure. Every patient complained of severe diffuse abdominal pain, at some time during the postoperative period. There were no other intestinal symptoms and the pain disappeared in a week or two. The complication of subacute bacterial endarteritis did not occur in any of the patients, nor were there any demonstrable emboli. Although the follow-up period was short (one to eight months), all the patients showed definite improvement at the time of discharge and the improvement has since been maintained.

Negative Postoperative Response to Arterenol.—Saini and Vytilingam (*Indian Journal of Surgery*, vol. 21, April, 1959) stated that when patients with severe mitral stenosis and coexisting pulmonary hypertension develop hypotension during or after operation for mitral stenosis, it has often been found that arterenol will not raise the blood pressure and may even cause a further drop. The authors studied a series of eight patients who had cardiac lesions (five had rheumatic heart disease, one had moderate pulmonary hypertension, one had an atrial septal defect, and one had an atrial septal defect and pulmonic stenosis) and one normal subject. Patients with severe pulmonary hypertension were excluded from the study, in order to avoid any deleterious effects of this drug on such patients.

All were studied during routine cardiac catheterization, and their resting pressures from the pulmonary wedge and pulmonary artery were recorded. The authors infused 2 mg. of arterenol in 5% dextrose drip directly into the pulmonary artery. The systemic blood pressure rose moderately within three to five minutes of injection. Four patients had normal pulmonary arterial pressures and three had slight and two moderate pulmonary hypertension. The systemic blood pressure showed a definite rise in all, with marked slowing of the heart rate. The pulmonary arterial pressure also showed a significant rise in all after the infusion, with a corresponding rise in pulmonary capillary pressure. The pulmonary arterial resistance was greatly increased in two and slightly increased in two. None showed a fall in cardiac output. Two patients developed respiratory distress. The increase in pulmonary resistance was less marked in patients with pulmonary hypertension than in the normal subjects. The negative response sometimes seen in patients with pulmonary hypertension may be due to the increase in pulmonary resistance caused by arterenol. The authors suggested that, when arterenol fails to raise the systemic blood pressure in these patients, hexamethonium and acetylcholine be tried.

Blood Pressure.—Sir Horace Smirk (*Journal of Postgraduate Medicine*, vol. 5, April, 1959) described casual blood pressure as the sum of the basal blood pressure, which in health is a physiological constant, and the supplemental blood pressure, which is variable. The blood pressure readings were low when the patient was reassured before taking the measurements, when he was admitted overnight to hospital and given a sedative the night before the reading, when his bladder and bowels were emptied in the morning if desired, and when the readings were recorded regularly at half-minute intervals for 15 minutes in a quiet room where the patient had slept. The lowest blood pressure thus obtained is the basal blood pressure. The supplemental blood pressure varies with the state of metabolic, physical, and emotional activity at the time of recording. Basal, casual, and supplemental blood pressures were measured in a series of 315 patients who were also investigated for clinical manifestations of cardiac hypertrophy, congestive heart failure, electrocardiographic evidence of left ventricular failure, and retinopathy, among other entities.

A positive correlation was noted between the systolic and diastolic basal blood pressure and the occurrence of these complications, but no such correlation was found to exist between these and the systolic or diastolic supplemental blood pres-

sure. The basal blood pressure is thus of greater clinical significance for prognosis and as an indication of need for treatment. These patients were reexamined after five and again after eight years. Again a positive correlation was found between the level of basal blood pressure and mortality, and no such correlation was observed between the level of supplemental blood pressure and mortality. The supplemental blood pressure rose with age. It was also influenced by an increase in metabolic, physical, or emotional activity.

The factors governing basal blood pressure are not precisely known. They are at least partly neurogenic, as the pressure tends to drop after sympathectomy and is also sometimes influenced by ganglion-blocking drugs. Other factors, however, are responsible for its maintenance, and these do not depend on neurogenic impulses. The levels of basal and supplemental blood pressure are not related.

Tuberculous Laryngitis.—N. P. Misra and co-workers (*Journal of the Indian Medical Association*, vol. 32, June 16, 1959) reported that the incidence of laryngitis as a complication of pulmonary tuberculosis has shown a significant diminution and has become more amenable to treatment since the advent of specific antituberculosis drugs. In a period of three years 1,330 patients with pulmonary tuberculosis were admitted to the G. R. Tuberculosis Hospital in Gwalior. Of these 34 or 3.2% had tuberculous laryngitis. It was most common in the group of those aged 21 to 40 years. The sputum in all was strongly positive for acid-fast bacilli. In 22 patients pulmonary symptoms were present six months to two years before the onset of laryngitis. All were treated with streptomycin and isoniazid. A spray of streptomycin solution containing cocaine gave symptomatic relief. Vocal rest, hot fomentations, and general antituberculosis measures were also used.

The results were good in 17, fair in 5, and poor in 12 patients, 6 of whom died. In the 22 who showed improvement there was marked relief from dysphagia, the pain disappearing completely within a week of starting treatment. The response was not so good in those with nodular lesions associated with progressive growth. Patients with chronic lesions associated with gross and irreparable damage did not show any improvement, but the improvement in those with generalized congestion and edema was remarkable. Although in some patients the laryngeal lesion disappeared completely, the pulmonary lesions did not show equally good regression.

Erythroblastosis Fetalis.—Raghavan and Menon (*Madras Clinical Journal*, vol. 25, April, 1959) stated that only about 5% of the population in India has Rh-negative blood, as compared to 13.5% of Europeans. They reported a series of six cases of erythroblastosis fetalis, five of which were due to Rh incompatibility and one to ABO incompatibility. All living patients were treated successfully. Three of the patients had a classic history: the first child was alive and healthy, the second was born but died within three days, and the third was aborted. The cases reported were the result of the fourth pregnancy. Two other patients had a history of only repeated abortions. Rh antibodies were demonstrated in the blood of the mothers and increased in titer as the pregnancy advanced. In one of them the titer of the antibody was rising steadily month by month, so that a cesarean section had to be performed two weeks before term to save the child, who received an exchange transfusion immediately after birth. The sixth patient had an ABO incompatibility. Both parents had Rh-positive blood. The mother's blood was group O, the father's group B, and the child's group B. The child was healthy when delivered but developed jaundice on the 2nd day of life. An ordinary blood transfusion was given immediately to raise the erythrocyte count and hemoglobin percentage. The jaundice gradually faded and the child recovered within a week. No exchange transfusion was necessary in this patient.

The authors suggested that in a case in which the newborn infant is likely to be affected by a hemolytic disease it is perhaps better to do a replacement transfusion immediately after delivery, especially if there is no facility to carry out an immediate Coombs' test. It is sometimes difficult to get Rh-negative blood for the exchange transfusion, as the percentage of persons with Rh-negative blood in India is small. Rh-negative blood of the particular blood group to which the baby belongs may be almost impossible to get in an emergency, and it is then easier to give Rh-negative group O blood, which was used for all the patients so treated in this series.

Tropical Eosinophilia.—Mukherjee and Ghose (*Antiseptic*, vol. 56, June, 1959) treated a series of 20 patients who had tropical eosinophilia with diethylcarbamazine citrate given intramuscularly. All the patients presented the classic symptoms: cough, difficulty in breathing, general debility, anorexia, and loss of weight. Examination of the chest revealed rales, rhonchi, and expiratory wheeze. The temperature was moderately raised. The total eosinophil count exceeded 5,000 per cubic millimeter. All adult patients were hospitalized and given 400 mg. of the drug on the first day. The dose was repeated after 48 hours. Children were given a correspondingly smaller dose. Most patients showed improvement on the second or third day after the first injection, and the improvement continued. The dyspnea was relieved completely in 11 patients and almost completely in the rest. The cough was relieved completely in four and partially in the rest. The mean total leukocyte count before

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treatment was 16,850 per cubic millimeter. Six days after treatment it had fallen to 13,050 per cubic millimeter. The eosinophil count came down from a mean value of 54% before treatment to 37.5%.

Three patients showed a slight fall in the hemoglobin level, in two it remained unchanged, and in the rest it showed some rise, although no hematinics were used. The sedimentation rate showed a fall in all patients but one. Fifteen men who were unable to do any physical work on admission were fit to resume work when discharged. There was little pain at the site of injection, and there were no undesirable side-effects. No recurrences were observed. The results on the whole compared favorably with those after oral therapy with the same drug, and the period of treatment was shorter, the results quicker, and the therapy less expensive.

Prevention of Prenatal Syphilis.—Rajam and Sowmini (*Journal of the Indian Medical Association*, vol. 32, June 1, 1959) studied the action of tetracycline in 12 pregnant women to find out its efficacy in the prevention of prenatal syphilis. All of the patients were in the second trimester of pregnancy and had clinical, biological, and serologic evidence of early syphilis, when chances of fetal infection are maximal. The husbands were also examined and treated simultaneously with crystalline penicillin G in 2% aluminum monostearate to prevent reinfection. The viability of the fetus was insured before starting treatment. The schedule of treatment consisted of 500 mg. of tetracycline by mouth every six hours for 12 days. Smears taken from the mouth, vagina, or rectum did not show any overgrowth of Candida albicans, and no toxic, allergic, or gastrointestinal reactions were met with in the course of treatment. Clinically the lesions showed a satisfactory involution.

Patients were discharged at the end of treatment and their progress followed by a monthly clinical and serologic examination. One of the 12 patients was lost to follow-up examination, and the rest delivered at full term. One had a stillborn infant as a result of prolonged, difficult labor, with breech presentation, conducted at home without an efficient obstetric service. The fetus was viable until the onset of labor and the mother showed no serologic evidence of the disease. The remaining 10 infants were normal clinically. Serologically only one infant had a passive transfer reaction, which disappeared within six months. The mothers and the infants were examined clinically and serologically for 6 to 24 months, and the results showed a complete prevention of prenatal syphilis and cure of infection in the mother in 10 of the 12 cases. This therapy is therefore useful in cases in which penicillin in any form is contraindicated. The high cost of the drug, as compared to penicillin, and the possibility of gastrointestinal reactions would, however, limit its routine use.

Carcinoma of Cervix Uteri.—P. S. Rao and coworkers (*Journal of the Indian Medical Association*, vol. 32, June 16, 1959) studied a series of 728 patients with symptoms suggestive of cervical carcinoma. The peak incidence was in the group of those aged 31 to 50 years. Its incidence in the premenopausal was slightly higher than in the postmenopausal years. No correlation was seen between early marriage and increased number of years of cohabitation and the incidence of cervical cancer, as has been reported by others. The age at first intercourse and age at first childbirth were found to be the same in patients with carcinoma of the cervix and those of a control series. The size of the family did, however, show a causal relationship to the incidence of this disease, the incidence being higher in parous than in nulliparous women. History of other members of the family having suffered from cervical cancer or cancer at other sites was obtained in 4.02%.

A high incidence was observed in Hindus and Christians whose male partners were uncircumcised. The male partners in this series showed higher grades of smegma accumulation. The disease was significantly uncommon, comparatively, among Moslems, who practice circumcision regularly. In the period of investigation 33 patients with carcinoma of the penis were reported, of whom 29 were Hindus and 4 Christians. None was encountered among Moslems. Five female partners of patients with carcinoma of the penis were examined. One had chronic cervicitis and four had healthy cervixes. A true correlation was seen between the incidence of carcinoma of the cervix and the circumcisional status of the male partner. Smegma accumulation under the foreskin of uncircumcised male partners thus seems to bear a close causal association with the incidence of carcinoma of cervix. No correlation with the frequency of coitus was noted.

NORWAY

Dexamethasone for Polyarthritis.—At the Drammen Hospital Kirkeby and Römcke (*Tidsskrift for den norske laegeforening*, June 15, 1959) treated 20 patients who had polyarthritis (14 of whom had previously been taking prednisone and 6 of whom had been taking triamcinolone) with dexamethasone. These patients had been taking steroid treatment for years and had reached a stage when discontinuation or reduction in dosage of the drug regularly increased their pain and stiffness. Some of them had been severely crippled by their rheumatism and by varying the steroid treatments had learned to discriminate between them. Most of the patients were enthusiastic about dexamethasone at first, but a close scrutiny of their reactions suggested that these reflected the ill-defined euphoria the drug induced rather than any material relief

of the rheumatism. While some preferred the new to the older steroids, others gave the opposite opinion. The antipyretic effect of dexamethasone was disappointing in two patients with fever. On the whole this new steroid is not inferior to the older steroids, and a dose of 0.8 mg. was as effective as 5 mg. of prednisone and 4 mg. of triamcinolone.

When Hypnotism Is Criminal.—Paragraph 364 of Norway's penal code provides a fine or imprisonment for whoever illegally uses any procedures whereby he puts someone, even with his own consent, into a state of hypnosis, weakness, or loss of consciousness. The physician who acts in this way in search of knowledge or the cure of disease is exempt from prosecution under this paragraph. It has now been invoked against a nonmedical popular entertainer who gave a demonstration of hypnotism in the gymnasium of a high school. The four boys who volunteered to act as experimental subjects responded to the various suggestions made by the entertainer with positive and negative hallucinations, a wand thrown on to the floor turning into a snake, and an imaginary orchestra playing. When the police instituted legal proceedings against the entertainer Harald Schjelderup, professor of psychology, was called as an expert witness. He condemned the performance on this occasion, holding that it was likely to do serious harm in the hands of the ignorant. The performer had to pay a fine.

Cancer in Gas Workers.—A. Bruusgaard (*Tidsskrift for den norske laegeforening*, June 15, 1959) analyzed the death certificates of 125 men who were over the age of 40 years and who had been employed for 5 or more years in a gas works. Among them were 41 in whom malignant growths were found post mortem. In 12 of these the growths were situated in the respiratory tract. Serving as controls were the 11,822 men over 40 years of age who had died in Norway in 1949. Among them were 173 who suffered from malignant growths of the respiratory tract, a rate of only 1.5 as compared with 9.6% for the gas workers. For this group the cancer rate irrespective of location was also significantly higher than for the same controls. In the gas workers the incidence of cancer of the respiratory tract was highest for the men who had worked in retort houses.

Phenylbutazone for Inoperable Cancer.—At the Aker Hospital Dr. O. Refvem (*Tidsskrift for den norske laegeforening*, June 1, 1959) treated 10 patients who had inoperable cancer with phenylbutazone, with even better results than he had anticipated after his first trials in 1955. He found that, when inoperable cancer was complicated by fever proving intractable to antibiotics, phenylbutazone reduced pain, nausea, sweating, and general malaise and cheered the patient by the euphoria it induced. Although this effect was transient, it could last for weeks and even months, making life easier for both the patient and his attendants. Some patients were able to walk about again or sit up in a chair, and in one obstructive jaundice disappeared for several months. The improved general condition and mobility enabled some patients to avoid bed sores, urinary infections, thromboses, and pneumonia, lengthening life by weeks and making nursing easier. In two the therapy had to be discontinued on account of the water retention it induced. The dosage should be as low as possible within an effective range, and it should not exceed 0.6 Gm. daily.

Nerve Injuries After Anesthesia and Operations.—K. A. Hartviksen of Ullevaal Hospital (*Nordisk medicin*, June 4, 1959) reported a series of 34 accidents to patients who had undergone anesthesia or operation. In only five of these had nerves been damaged at a point remote from the field of operation. In these five patients the limbs were involved, and the injury must have been inflicted by faulty positioning of the patient at the time of the operation. None of these paralyses proved to be permanent, but some of them lasted up to two months. In none of the 34 patients in this series could the nerve injury be traced to stasis bandaging intended to empty blood vessels, and the author ventured the guess that this negative observation might help to exonerate ischemia as a factor in the genesis of nerve injuries. He noted, however, that much has yet to be learned with regard to the comparative importance of such factors as ischemia, anoxia, general dehydration, electrolyte disturbances, and vitamin deficiency to the genesis of nerve injuries.

UNITED KINGDOM

Drugs, Patients, and Politicians.—The Secretary of the British Medical Association (BMA) outlined some of the advantages and disadvantages of the report of the Hinchliffe Committee on the cost of prescribing. The high and rising drug costs, to which the committee referred, remain the principal deterrent to private medical practice and perpetuate the social injustice inflicted on a group of persons who, merely because they prefer to make private arrangements for medical care, are denied the right given to all other persons to have necessary drugs provided by the state. The BMA has presented a practical scheme to the Ministry of Health. By comparison with the cost of the National Health Service, the money involved is negligible and it is hoped that the ministry will put into practice a principle which its predecessors have repeatedly said is not repugnant to the government.

CORRESPONDENCE

INTRAVENOUS FIBRINOLYSIN THERAPY

To the Editor:—In THE JOURNAL, June 27, page 101, Dr. Paul W. Boyles reported a severe systemic reaction to intravenous fibrinolysin therapy, with high fever, hypertension, angioneurotic edema, and mental confusion. While patients I have treated with the preparation that he used have shown some febrile reactions and while it is hoped that a more purified product will reach the market, attention should be called to two factors that may have contributed to the severity of the reaction. First, 200,000 units is twice the recommended dose; in fact, 50,000 units as a starting dose is probably safer. Second, the injection is customarily given slowly over a period of two to five hours and dissolved in 500 cc. of 5% dextrose solution and not given in 15 minutes as in the reported case. We have given concentrated solutions intra-arterially only, hoping they would act regionally on the soft fresh clot.

There are curious things about the reaction described, in that the clotting time was prolonged, not immediately, but 20 hours after the administration of heparin. This can hardly be attributed to the single dose of 100 mg. of heparin. Also, the greatly increased fibrinolytic activity, not immediately but 20 hours later, is unusual as a direct result of the infused fibrinolysin. All this would suggest a true anaphylactic shock and means endogenous mobilization of heparin and fibrinolysin. It looks then as if this delayed reaction were a nonspecific effect of parenterally administered protein. It is likely that much of the currently popular enzyme therapy is brought about in this manner, though in a less intense form.

GEZA DE TAKATS, M.D.
104 S. Michigan Ave.
Chicago 3.

ERYTHEMA NODOSUM AND HISTOPLASMOSIS

To the Editor:—In the clinical note "Erythema Nodosum as a Manifestation of Histoplasmosis" in THE JOURNAL, July 4, page 1178, the authors stated that "to our knowledge there has been no reported association of this syndrome with histoplasmosis." In order that the facts be correctly documented, I would like to call attention to an article by Heilbrunn and Cain, entitled "Mild Histoplasmosis Clinically Resembling Atypical Pneumonia and Accompanied by Erythema Nodosum and Arthritis" (*J. Missouri M. A.* 47:503 [July] 1950). In this report a patient is described who was given a diagnosis of histoplasmosis, as a result of laboratory tests conducted by the United States Public Health Laboratory at the University of Kansas Medical Center. The patient is reported as having, among other findings, skin lesions described as "resembling erythema nodosum."

GEORGE X. TRIMBLE, M.D.
1401 Chestnut Ave.
Long Beach 13, Calif.

MISCELLANY

USE OF COMMERCIAL BACTERIOPHAGES FOR STAPHYLOCOCCUS TYPING

Statement from the Committee on Staphylococcal Phage Typing, Laboratory Section, American Public Health Association.

The Committee on Staphylococcal Phage Typing of the Laboratory Section, American Public Health Association, cautions potential users of currently available, commercial bacteriophages for typing of staphylococci that trustworthy results cannot be expected unless the following criteria are satisfied:

1. The procedure must be carried out by a qualified microbiologist specially trained in phage typing techniques.

2. Before use, each phage must be titrated against its standard propagating strain to determine the Routine Test Dilution (RTD) for use; preliminary tests show that reconstitution without titration will frequently lead to confusing results.

3. Unless data on the lytic spectrum of each batch of each phage can be furnished by the supplier, each user must first test each phage preparation against all standard propagating strains at RTD before assuming that a standard pattern will result from its use; such data are needed before results obtained can be interpreted or considered epidemiologically significant.

4. After reconstitution and dilution based upon titration, each phage dilution should be tested against its homologous culture for production of confluent lysis each time unknowns are typed.

The committee regrets that no scheme for application of bacteriophage typing techniques without satisfaction of these criteria has yet been developed and found feasible. The committee's general statement on the availability and uses of staphylococcic phage typing is awaiting publication in the *American Journal of Public Health.*

Members of the Committee on Staphylococcal Phage Typing, Laboratory Section, American Public Health Association, are John E. Blair, Howard L. Bodily, Evan T. Bynoe, Jean-Marc Desranleau, Valerie Hurst, George G. Jackson, Vernon Knight, Marie Mulhern, Elaine Updyke, Robert I. Wise, and Earle K. Borman, Chairman.

MEDICAL LITERATURE ABSTRACTS

INTERNAL MEDICINE

Cytological Examination of Pleural and Peritoneal Punctates for Malignant Tumor Cells (Smear Method). R. K. S. Goei. Nederl. tijdschr. geneesk. **103**:774-777 (April 11) 1959 (In Dutch) [Amsterdam].

During the period from Jan. 1, 1956, to March, 1958, the author obtained pleural and peritoneal punctates from 50 patients from his own department of internal medicine and from a sanatorium for pulmonary tuberculosis. In 45 of these patients a definite diagnosis had been established by clinical observation or histological examination. The other 5 patients, in whom the diagnosis was doubtful, were excluded from this study. Immediately after puncture, heparin was added to the punctate, and it was centrifuged at 2,000 rpm for 15 minutes. At least 4 smears were made from each sediment, and these were examined for malignant tumor cells. Two false-negative and no false-positive results were obtained in 17 patients with malignant tumors of the pleura or peritoneum, and in 28 patients with benign conditions.

Primary Atrophy and Lipomatosis of the Pancreas. L. G. Bartholomew, A. H. Baggenstoss, C. G. Morlock and M. W. Comfort. Gastroenterology **36**:563-572 (May) 1959 [Baltimore].

The purpose of this study is to describe a syndrome of pancreatic atrophy associated with clinical evidence of pancreatic insufficiency and to attempt to demonstrate a possible relationship between atrophy and lipomatosis of the pancreas. The rarity of this entity is evidenced by the fact that reports of only 6 cases were found in the world literature. The authors report 2 additional cases in a 72-year-old woman and a 74-year-old man who were observed at the Mayo Clinic in 1948 and 1955 respectively.

Primary atrophy of the pancreas is an unusual pancreatic disease, characterized pathologically by almost complete disappearance of the acinar cells and by disappearance of the islets of Langerhans to a lesser extent. Fatty replacement, varying from mild fatty infiltration to massive replacement of the organ by adipose tissue, may accompany this atrophy. No specific causative factors have been demonstrated. The possible relationship to other systemic diseases, to malnutrition and dietary deficiencies, or to an unusual form of chronic pancreatitis has been considered. The characteristic clinical state is one of a deficiency syndrome associated with steatorrhea, loss of weight, normal or increased appetite, and occasionally edema, anasarca, and diabetes mellitus. Although the disease may possibly develop in childhood, it appears to be more frequent after the 5th decade of life. Surgical exploration of the pancreas may be necessary to establish the diagnosis. Recognition of this syndrome is important, since it represents a benign pancreatic disease that responds to adequate replacement therapy.

Primary Lymphosarcoma of the Stomach: A Clinical Study of Seventy-Five Cases. A. I. Friedman. Am. J. Med. **26**:783-796 (May) 1959 [New York].

The author reports on 45 men and 30 women, between the ages of 28 and 73 years, with primary lymphosarcoma of the stomach, who were operated on at the Mount Sinai Hospital in New York between 1934 and 1954 and were followed up for periods ranging from 1 month to 20 years. Of the 75 patients, 64 had microscopically verified, small, round-cell lymphosarcoma, and 11 had reticulum-cell lymphosarcoma. No characteristic clinical or laboratory findings could be discerned. The finding of normal or high values of free hydrochloric acid in the presence of large and evidently malignant lesions of the stomach may suggest lymphosarcoma. Perforation occurred in 11 patients (14%). Patients with this complication have the poorest prognosis.

Pathological examination of the operative specimens revealed grossly 5 forms of lymphosarcomatous lesions, namely, multiform-infiltrative, ulcerative, nodular, polypoid, and combined lesions. The ulcerative form, occurring as a shallow localized ulcer, was present in 33 patients (42%) and represented the most frequently observed type. Involvement of the duodenum was noted in 6 patients, and that of the esophagus in 3. Fifteen patients (20%) either were alive more than 5 years after the diagnosis was established or had died, after 5 years, of other causes with no evidence of recurrent lymphosarcoma. Seven patients were alive and presumed to be cured more than 10 years after surgical inter-

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vention, with no evidence of recurrence. Because recurrences appeared as late as 9 years after treatment, the prognosis in patients with lymphosarcoma of the stomach must be guarded. The most effective program of therapy appears to be definitive surgical treatment, followed by irradiation. Rarely, a patient may be cured by roentgenotherapy alone, but cure is more frequent by adequate surgery alone. The prognosis in patients with lymphosarcoma of the stomach and lymph node involvement appears to be more favorable than that in patients with carcinoma of the stomach with comparable spread.

Primary Cancer of the Liver: Clinicopathological Study of 49 Cases. H. Dooner and G. Rojas. Rev. méd. Chile **87**:238-243 (April) 1959 (In Spanish) [Santiago].

The authors emphasize the problem of diagnosis in cancer of the liver, which is always difficult. They report on 49 cases of primary hepatic cancer, representing 0.39% of a total of 12,512 autopsies performed at the Hospital San Borja in Santiago, Chile, between 1932 and 1957. Twenty-nine cases had occurred in women. The ages of the patients ranged from 20 to 77 years, with an average of 54. In 39 cases the tumors had been classified: 29 tumors were hepatomas; 9, cholangiomas; and 1, hepatocholangioma. Records of 33 cases included comparative clinical, laboratory, and anatomicopathological data. In 9 of these 33 cases the diagnosis had been established clinically; in 5 it was made by exploratory laparotomy and biopsy. The main symptoms were abdominal or epigastric pain in 26 cases (initial symptom in 17), weakness in 20 cases (initial symptom in 5), and sudden enlargement of the abdomen and legs in 17 cases (initial symptom in 6). The average duration of symptoms before hospitalization was 86 days. The course during hospitalization was recorded in 37 cases; in 29 (78%) the duration was less than a month, and in 7 of these it was less than a week. The longest duration was 4 months in 2 cases. Metastases were found in 29 cases (59%). The organs involved most frequently were the lungs; this involvement occurred more often in connection with cholangioma than with hepatoma. Metastatic involvement of the gallbladder and the sternum ranked next in frequency. Hemorrhagic complications occurred in 16 cases (32%). This study indicates a low frequency of cancer of the liver in Chile in contrast to a high frequency of hepatic cirrhosis.

Dermatomyositis and Malignancy: A Review of the Literature. R. C. Williams Jr. Ann. Int. Med. **50**:1174-1181 (May) 1959 [Lancaster, Pa.].

Whether the symptom complex which presents itself as dermatomyositis is truly one disease is open to question, particularly in view of the incidence of associated malignancy. Among 590 patients with dermatomyositis reported in the literature, 92 had a malignant tumor. There was an almost equal representation of the 2 sexes in these 92 cases, and the ages of the patients ranged from 40 to 70 years. The associated malignancies were in the following sites: 16 in the stomach, 15 in the breast, 14 in the lung, 10 in the ovaries, 4 in the gallbladder, 4 in the colon and rectum, 3 in the kidney, 3 in the uterus, and 3 in the larynx; 9 patients had lymphoma or leukemia.

The clinical picture of dermatomyositis was more sharply defined in patients with than in those without accompanying malignancies. The onset was usually acute with a rash on the parts of the body exposed to the sun, e. g., face, dorsum of hands, arms, neck, and thorax. In 20 of 58 cases in which full histories were available, skin rash preceded muscular symptoms of pain, weakness, or loss of substance. The character of the skin lesions varied from edema and mild erythema to florid, blue-red, mottled, purpuric eruptions with desquamation and intense pruritus. In many patients the skin manifestations were misinterpreted initially as being those of disseminated lupus erythematosus. Muscular symptoms, degree of eosinophilia, electrical reaction of muscles to galvanic and faradic current, creatinuria and creatine tolerance were similar in patients with dermatomyositis alone and in those with neoplasm and dermatomyositis. In 47 of 58 patients dermatomyositis preceded clinical or pathological recognition of associated tumor, whereas in 11 dermatomyositis developed after the tumor had been discovered. Treatment of the associated malignant lesion was followed by improvement in the dermatomyositis, especially in patients with carcinoma of the ovaries and the breast, and in one instance amelioration of skin rash and muscle complaints was reported after gastrectomy for carcinoma of the stomach. The effect of tumor therapy upon dermatomyositis remains obscure in the majority of cases reviewed, either because no tumor was suspected before death, or because effective treatment was not available.

SURGERY

Elongate Coarctation of the Aorta. F. Milloy and E. H. Fell. A. M. A. Arch. Surg. **78**:759-765 (May) 1959 [Chicago].

The authors present observations on 4 patients with elongate coarctation of the aorta, who were operated on at either the Cook County or the Presbyterian Hospital of Chicago during the past 10 years. The elongate coarctations involved the aorta in the region between the arch and the renal vessels. A review of the literature revealed 14 similar reports, although some probable cases were eliminated because of a lack of specific information concerning the length of the coarctation. The data

on the 14 cases collected from the literature and on the 4 whose histories are presented here are tabulated. It appears that elongate coarctation has no racial limitations. There are several differences between the usually encountered adult type of short coarctation of congenital etiology and the elongate type of coarctation, which evidently may be of congenital or acquired etiology. The sex incidence of the 2 entities is definitely reversed. The commonly encountered adult type occurs more frequently in males, in a ratio of 2:1 or 3:1, while the rare elongate type is reported more commonly in females. It is usually located below the isthmus and may involve the abdominal aorta, whereas the typical, sharply constricting, adult coarctation of congenital origin occurs at the isthmus in the vast majority of cases.

There is frequently evidence of an inflammatory process involved in elongate coarctation, characterized by induration and thickening of the aortic wall and overlying pleura and microscopic findings of perivascular round-cell infiltrations. These findings suggestive of chronic inflammation have led some observers to believe that there might be an acquired etiology for this condition. Since the great vessels leaving the aortic arch may be involved by a nonspecific chronic arteritis, it is conceivable that a similar process may involve the aorta itself and that there may, in fact, be an inflammatory element in the etiology of some of these constrictions. From the observations made at surgery in these 4 cases, as compared with the previously described cases, it would seem that the first case presented could have been of acquired etiology and that the other 3 cases were probably of congenital origin. The treatment of this condition, when possible, consists of an aortic prosthetic replacement or bypass.

Simultaneous Repair of Mitral and Tricuspid Valves Through Right Atrium and Interatrial Septum. O. C. Julian, M. Lopez-Belio, W. S. Dye and others. A. M. A. Arch. Surg. **78**:745-754 (May) 1959 [Chicago].

Secondary tricuspid regurgitation is frequently responsible for serious downgrading of the clinical status of patients whose only primary rheumatic valvular lesion is of the mitral valve. In some instances the signs of tricuspid insufficiency disappear during medical preparation for standard mitral commissurotomy. In others the disturbed dynamics which result from the tricuspid failure cannot be reversed, and the patient must be operated on for the mitral lesion in spite of the defect. If sufficient benefit accrues from the operation to diminish right-heart work load, the tricuspid ring shrinks as right ventricular distention disappears. Tricuspid valvular sufficiency then results as a delayed benefit of mitral valve commissurotomy or repair. The question arises as to whether repair of the tricuspid regurgitation, accomplished at the same time as repair or commissurotomy of the mitral valve, would be beneficial in terms of providing more rapid and certain improvement in cardiac competency.

A group of 8 patients having primary mitral valvular deformity and intractable secondary tricuspid insufficiency were subjected to simultaneous operation on both valves. Repair was done under total cardiopulmonary bypass by way of the lateral wall of the right atrium and the interatrial septum. Plication of the annulus of the tricuspid valve was done in each case. Either direct-vision commissurotomy or annulus plication was done on the mitral valve. Two operative deaths and 2 late surgical deaths occurred in this series of poor-risk patients. Four favorable results were obtained in the survivors, whose preoperative state was comparable to that of the patients who did not survive.

Prognosis in Metastatic Tumors of the Brain and the Skull: An Analysis of 16 Operative and 162 Autopsied Cases. D. M. Perese. Cancer **12**:609-613 (May-June) 1959 [Philadelphia].

This paper is concerned with the author's personal experience in the operative treatment of 16 patients with metastatic tumors of the brain and an analysis of 162 patients with metastatic brain and skull tumors in a series of 727 complete autopsies. All 16 patients were known to have a primary cancer elsewhere in the body before the operation. The reason for the operation in every patient was objective evidence of increased intracranial pressure caused by a space-occupying lesion. In addition, all the patients demonstrated various degrees of neurological deficit, such as impairment of memory, speech, or sensation, weakness, or paralysis. With the exception of one patient with adenocarcinoma of the breast and of another with teratocarcinoma of the testes, all the patients were in fair physical condition before the operation and were not completely disabled.

Thirteen of the 16 patients died within less than 12 months after the onset of their symptoms, despite the operation. Of the remaining 3 patients, one survived 2½ years after operation. (This patient would probably have lived longer had not a fatal complication resulted from the use of a potent chemotherapeutic agent while he was under the care of another physician.) Another patient with metastatic grade 1 follicular carcinoma of the thyroid is still alive 3½ years after operation. The last patient, the one with metastatic teratocarcinoma of the testes, has during the past 4 years survived 3 craniotomies, a pneumonectomy, and 2 abdominal operations for the removal of isolated widespread metastases. He has at the present time no disability

other than homonymous hemianopsia on the right side and slight exertional dyspnea. In other words, there have been only 2 patients out of 16 who have survived more than 3 years and who are enjoying fairly good health without major disability. However, credit is also due to the radiation therapy administered to both of these patients. In the group of 13 patients surviving less than one year, only those surviving at least 2 weeks after operation received irradiation and/or chemotherapy.

Patients with metastatic brain tumors of pulmonary origin have an expected life span of approximately 3 months after the appearance of cranial symptoms. Operative intervention is not likely to extend this period. In patients with breast tumors metastatic to the brain, the survival period varies from 4.5 to 8.2 months with or without operation. Because of the availability of hormonal and chemical therapy as well as irradiation to induce effective remissions in cerebral metastases, direct operative attack upon these metastatic tumors is rarely indicated, and the results are not better than are those with nonoperative therapy. In the less commonly seen metastatic brain tumors, such as hypernephroma, thyroid carcinoma, and teratocarcinoma of the testes, postoperative survival of several years' duration (ordinarily beyond 3 years) has been reported. The longest operative survivals are obtained in patients with single large tumors located in the nondominant hemisphere of the brain.

Indications and Contraindications to Mitral Commissurotomy. A. Pasanisi and A. Reale. Policlinico (sez. prat.) **66**:477-486 (April 6) 1959 (In Italian) [Rome].

The authors discuss the postoperative results, observed within a year after the operation, in 920 patients who underwent mitral commissurotomy prior to February, 1958. Pure mitral stenosis was present in 530 patients; mitral stenosis was the main condition in 348; and mitral insufficiency was the chief disorder in 30. Exploratory thoracotomy or cardiotomy was performed on 12 patients. Results of mitral commissurotomy were good in 593 patients and fair in 199, but the operation was a failure in 37. Of 9 patients in whom mitral stenosis recurred, 6 underwent another operation and benefited from it. There were 15 deaths among the patients who had mitral stenosis and sinus rhythm and 56 deaths among those who had mitral stenosis associated with atrial fibrillation. Systemic embolic state ascribed to the operation developed in 4 patients with mitral stenosis and sinus rhythm and in 33 patients with mitral stenosis and atrial fibrillation. Of 22 patients who underwent mitral commissurotomy during pregnancy, remission of the heart condition permitted an uninterrupted and successful termination of pregnancy in 21.

Mitral commissurotomy is indicated in patients with mitral stenosis and sinus rhythm who have hypertension of the pulmonary circulation, or in those who have normal blood pressure, provided that the left atrioventricular diastolic gradient is above 8 mm. Hg. Presence of an acute pulmonary edema during an episode of mitral stenosis calls for mitral commissurotomy as an emergency measure. Mitral commissurotomy is not contraindicated in patients with mitral stenosis at an advanced age or in conditions in which mitral stenosis is associated with either an active rheumatic process or pregnancy up to the 5th month. Mitral commissurotomy affords improvement in most instances in which such improvement could not be obtained by medical means alone.

Tumors of the Thymus (with Respect to 12 Case Reports). R. Sauvage, H. Le Brigand, M. Merlier and J. Moreaux. Presse méd. **67**:590-593 (March 25) 1959 (In French) [Paris].

Twelve patients with tumors of the thymus were seen at the Marie-Lannelongue Surgical Center in Paris between 1949 and 1958. The tumors were verified by surgical intervention and anatomicopathological examination. Such tumors are rare, having constituted only 6.6% of the 180 mediastinal tumors treated by the authors. Three of the 12 tumors were malignant. For the diagnosis of malignancy, the criteria of multiplicity and local extension were as important as the histological study. Sometimes malignancy might be affirmed only by the occurrence of a relapse. Symptomatology occurred in one of the 12 patients and included chest pain, effort dyspnea, and cough. A radiographic sign which is suggestive of the thymic origin of the lesion is its location in the middle part of the anterior mediastinal space. An ectopic thymic cyst has been observed in the vicinity of the pulmonary hilus.

In this series, severe anemia was observed in one patient and myasthenia in another. The combination of myasthenia and tumor of the thymus has a poor prognosis, and operation on such patients should be avoided if possible. If there is surgical intervention, it should be preceded by radiotherapy; doses of neostigmine are increased, and use of curare is proscribed. In the absence of myasthenia, however, operation is indicated. Exeresis is easy in most cases, because an encapsulated tumor situated directly beneath the mediastinal pleura can easily be freed. Some pericardiac adhesions, though, may necessitate resection of a fragment of the pericardium. Results depend on the nature of the tumoral process. Radiotherapy is indicated in case of malignancy, but in this series results were disappointing in 2 patients with malignancies. The authors emphasize the difficulty of recognizing benign and malignant tumors of the thymus.

BOOK REVIEWS

Intra Vascular Catheterization. Compiled and edited by Henry A. Zimmerman, M.D., B.S., Chief of Cardiovascular Section, Division of Medicine, Director of Marie L. Coakley Cardiovascular Laboratory, St. Vincent Charity Hospital, Cleveland. Cloth. $16.75. Pp. 782, with illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill.; Blackwell Scientific Publications, Ltd., 24-25 Broad St., Oxford, England; Ryerson Press, 299 Queen St., W., Toronto 2B, Canada, 1959.

The editor of this volume has assembled a number of significant survey articles concerned with various technical and interpretive aspects of cardiac catheterization. The most comprehensive and valuable chapters deal with catheterization of the left heart, pressure curve analysis, congenital heart disease, shunt flows, valve areas, and applications of indicator dilution curves. Other sections discuss acquired heart disease, the pulmonary circulation, selective angiocardiography, the technique of cardiac catheterization, and a number of other related subjects, including intracardiac electrocardiography and renal, hepatic, and cerebral circulation studies.

The multiple authorship has resulted in considerable repetition in several areas, e. g., mitral valve hemodynamics, whereas a number of general problems regarding cardiac catheterization appear to have been inadequately examined. In particular, the general material on methodology and instrumentation could well be expanded, since profitable interpretations are so completely dependent on accurate data. This volume presents a collection of valuable information on selected topics in the field of clinical hemodynamics for both the newcomer and the experienced worker.

The Functions of the Endocrine Glands. By Peter F. Hall, M.D., M.R.C.P., M.R.A.C.P., Assistant Physician, Sydney Hospital, Sydney. Cloth. $5.75. Pp. 290, with 77 illustrations. W. B. Saunders Company, 218 W. Washington Sq., Philadelphia 5; 7 Grape St., Shaftesbury Ave., London, W. C. 2, England; Horwitz Publications, Inc., Horwitz House, 398-402 Sussex St., Sydney, N. S. W., Australia, 1959.

This book deals mostly with developmental anatomy and to a lesser extent with histology. The material presented is basic, but it is incomplete as regards its usefulness to both the student of medicine and to the graduate physician. The practicing physician will find the material inadequate with regard to clinical application. The illustrations are schematic and for the most part too simplified, but the chemical formulas are adequate. The subject matter and data are derived more from laboratory animals than from human beings. The author, in the introduction, states that his plan of presentation endeavors primarily to discuss the function of the endocrine glands in terms of the chemistry and action of the hormones which they secrete. However, many of the newer hormones, naturally occurring or synthesized, are either not mentioned at all or their action is insufficiently explained to make the book one of much practical value. Although some of the references are good, many are inadequate and out of date.

Neo-Natal Paediatrics. Edited by W. R. F. Collis, M.D., F.R.C.P., F.R.C.P.I., Director of Department of Paediatrics, Rotunda Hospital, Dublin, Ireland. Cloth. $5. Pp. 301, with 35 illustrations. Grune & Stratton, Inc., 381 Fourth Ave., New York 16; 15/16 Queen St., Mayfair, London, W. 1, England, 1958.

The purpose of this volume is to discuss the examination, the clinical problems, and the care of the newborn infant. It is a relatively small book and the amount of information is, in most cases, presented in an abbreviated form. Some subjects, such as the care of the premature infant and the care of the infant with pyloric stenosis, are discussed in detail and outlines of treatment are given. The authors present their opinions about some matters that do not agree with common practice in the United States. The use of thyroid for premature infants is recommended and the routine use of circumcision is stated to be unwise. The book is well written, with adequate illustrations. The bibliography is limited but current. The book summarizes the medical care of the neonate in commendable fashion.

The Hand: Its Anatomy and Diseases. By John J. Byrne, M. D., Director, Third (Boston University) Surgical Service and Research Laboratory, Boston City Hospital, Boston. Cloth. $10.50. Pp. 384, with 166 illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill.; Blackwell Scientific Publications, Ltd., 24-25 Broad St., Oxford, England; Ryerson Press, 299 Queen St., W., Toronto 2B, Canada, 1959.

This book is a welcome addition to the other works on the same subject. Although the bulk of the material is well known and repetitious, the simplicity of the presentation makes it worthwhile. The hand is a complex subject, and the author has succeeded admirably in simplifying and presenting succinctly the injuries and diseases that may affect this structure. Chapter 2, which discusses the embryology of the hand, is especially good. Although briefly stated, this often neglected phase of the subject warrants reading and rereading. The illustrations ably amplify the text. This book can be recommended to anyone interested in the hand.

These book reviews have been prepared by competent authorities but do not represent the opinions of any medical or other organization unless specifically so stated.

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QUESTIONS AND ANSWERS

THYROID CRISIS AND ACUTE THYROIDITIS

To the Editor:—*Please outline the latest method of treating thyroid crisis and acute thyroiditis.*

Walter Weinberger, M.D., Hollidaysburg, Pa.

Answer.—In current practice, thyroid storm is seldom seen except after intercurrent surgery, injury, or infection. Broad-spectrum antibiotics are therefore employed, or, when the sensitivities of the organism involved have been identified, more specific agents. The sharp hyperpyrexia of thyroid crisis is combated by cooling the patient in an oxygen tent or by colonic irrigation. Oxygen is usually provided in view of the circulatory strain, and, if necessary, digitalis is given. Adrenal cortical steroids may be employed for their antipyretic action. Fluid loss must be replaced, and control must be maintained over electrolyte balance. Saline solution or saline and dextrose solution is given intravenously with an eye toward meeting the greatly increased caloric requirements that develop in thyroid storm. Drip feeding by nasal tube is instituted as soon as feasible. If time permits, and the patient can take medication orally, massive doses of an antithyroid drug, e. g., propylthiouracil (0.25 Gm. every four to six hours), are given. This is followed after several hours to 24 hours by administration of sodium iodide, 0.1 Gm. intravenously, and subsequently, at 24-hour intervals, intravenously or by mouth. Sedation with reserpine, phenobarbital, or other agents is essential. With constant watch by professional and nursing staffs, attention to the patient's airway and to the details above, a high recovery rate is possible.

The symptoms and signs of acute (subacute) nonsuppurative thyroiditis are admirably controlled by ACTH and the cortical steroids or their derivatives. These agents are used to control the disease in the expectancy that spontaneous remission will ultimately supervene. Treatment is suspended at intervals. When no flare-up in the disease occurs, the patient usually goes on to complete recovery without further therapy. ACTH is injected intramuscularly in doses of 25 mg. every six hours. Generally, oral medication is preferable, for example, prednisone, 5 mg. every six hours. This dose is soon reduced to 2.5 mg. every six hours. X-ray therapy to the thyroid is employed by some, but its efficacy has not been evaluated in the light of the known high incidence of spontaneous remission which may end the disease a week to three months after diagnosis. An extensive discussion of these conditions will be found in standard textbooks such as "The Thyroid: Fundamental and Clinical Text" (edited by S. C. Werner, New York, Paul B. Hoeber, Inc., 1955).

The answers here published have been prepared by competent authorities. They do not, however, represent the opinions of any medical or other organization unless specifically so stated in the reply. Anonymous communications cannot be answered. Every letter must contain the writer's name and address, but these will be omitted on request.

EXTENSIVE X-RAY EXPOSURE

To the Editor:—*A 58-year-old woman has just had a rectal malignant growth removed surgically for the second time by perineal-abdominal operation with colostomy. There was no evidence of metastasis. From age 22 to 23 she had an indeterminable amount of body radiation while working as a nurse in a radium clinic, manipulating radium appliances. At age 30 she had x-ray therapy of a breast, preoperatively, because cancer was suspected. Biopsy was negative for cancer. At about age 40, she developed gastrointestinal symptoms. Diverticulosis was found. X-ray studies were performed about six times during the course of 16 years. She then had a series of 10 attacks of acute bursitis in both hips, one foot, and both shoulders. Fluoroscopy or x-ray of the joints was done each time, and then radiation therapy was instituted. Occasional chest x-rays have been taken in the course of routine check-up. Should periodic barium enemas be performed with the hope of identifying possible rectal cancer recurrence or metastasis while it may still be operable? Is there a possible connection between the malignancies and the large amount of radiation this woman has received? Should further diagnostic radiation be avoided on this account? What is the prognosis in this case? What would be the earliest symptoms of another recurrence?*

M.D., New York.

Answer.—The inquiry does not state what kind of operation was performed for the first malignancy in the rectosigmoid. Assuming it was an anterior resection, the recurrence, for which a later combined abdominal-perineal resection was performed, was the type of recurrence sometimes associated with implantation of tumor cells at the site of anastomosis or just beneath it. After a combined abdominal-perineal resection for carcinoma of the rectum, an intraluminal recurrence of cancer in the higher reaches of the colon should not be expected. If a carcinoma occurred, it certainly would be regarded as a new cancer. Periodic barium enemas would be of no value in identifying an early recurrence because this would most likely be in the regional lymph nodes, para-aortic lymph

nodes, or the liver. There is, however, no contraindication for a periodic barium enema if symptoms should so indicate.

There is no connection between development of the malignancies in the rectum and rectosigmoid area and the amount of radiation received by this woman. The radiation given was in entirely different, unrelated areas. Further diagnostic radiation is not contraindicated. Prognosis could best be decided by the surgeon on the basis of his findings. The early symptoms of another recurrence would vary greatly, depending on the site of the recurrence. Local recurrences in the pelvic area should be checked by periodic pelvic examination and by inspection and palpation of the perineum and inguinal nodes. Periodic examination of stools for occult blood may be helpful in detecting a new growth promptly. A colonic exfoliative cytology study might also be done periodically. There appears to be no indication for further diagnostic x-ray unless symptoms, such as occult blood in the stools, warrant such an examination.

TESTOSTERONE IN ADRENAL CORTICAL HYPOFUNCTION

To the Editor:—*A 35-year-old woman, with normal menses, without libido, had adrenal cortical hypofunction (Addison's disease). What effect would testosterone have in relation to general feeling of well-being, physiological state, and libido? Is testosterone to be routinely used in the management of this disease? If so, what general dosage range is recommended?*

M.D., Virginia.

Answer.—Libido in the female is largely dependent on the presence of the androgenic hormones of the adrenal cortex. In a patient with adrenal cortical hypofunction, the general feeling of well-being is often achieved by proper control of the adrenal cortical insufficiency. Testosterone propionate, as well as other forms of testosterone, has proved to be very beneficial in the long-range management of such patients, particularly women. Relatively small amounts of testosterone, such as 25 mg. of the propionate given intramuscularly weekly, are sufficient to maintain adequate libido and potentia without any virilization or change in menses. The dosage of testosterone, whether given intramuscularly or orally, has to be tailored for the individual. It must be kept in mind that the dark-complexioned, brunette woman is more likely to be sensitive to testosterone preparations, particularly as concerns mild hirsutism, than the light-complexioned, blonde woman. Methyltestosterone in doses as small as 10 mg. three to four times weekly is often sufficient to enhance the feeling of well-being and improve the libido. It is suggested that testosterone propionate or methyltestosterone be used first to standardize the patient's requirements before any of the long-acting intramuscularly given testosterone preparations or the newer orally given halogenated testosterone derivatives are used.

OPPOSING CORTISONE EFFECTS

To the Editor:—*Is there a drug to neutralize the action of cortisone preparations?*

M.D., Pennsylvania.

Answer.—Where cortisone and the corticosteroids are used excessively, or in the case of adrenal cortical hyperfunction (Cushing's syndrome), in which there is excessive production of hydrocortisone, the use of testosterone propionate (25 to 50 mg. daily, gradually reduced to three times weekly) will counteract the nitrogen and potassium loss. It usually is employed for a relatively short time, either in preparation for surgery or when a patient has been overtreated with corticosteroids, to better maintain electrolyte balance during the recovery phase from the relative adrenal insufficiency that occurs with excessive doses of cortisone and its derivatives. Amphenone [1, 2-bis (*p*-aminophenyl)-2-methylpropanone-1] shows promise in blocking endogenous hydrocortisone production.

POSTOPERATIVE PULMONARY EMBOLISM

To the Editor:—*This is a comment on the question and answer "Postoperative Pulmonary Embolism," which appeared in* The Journal, *March 28, 1959, page 1344. In 1940 there was an article in* Surgery, Gynecology and Obstetrics *by Frykholm (71:317 [Sept.]), reporting the autopsy findings in deaths due to embolism or phlebothrombosis and suggesting a prophylaxis. The explanation in this article was reasonable, and during the 19 years of practicing this prophylaxis I have had not one case of phlebothrombosis or pulmonary embolism.*

Duncan C. McKeever, M.D.
4310 Rossmoyne
Houston, Texas.

The above comment was referred to the consultant who answered the original question, and his reply follows.—Ed.

To the Editor:—*The letter from the physician in Texas concerning his experience with the Frykholm technique of preventing venous thrombosis is worthy of consideration. He attributes his lack of embolism to the use of the prophylactic technique, but I think he is attributing too much of it to the method and believe that he has just been fortunate. As every student of thromboembolism knows, there is a wide variability in the incidence of thromboembolism and one must be extremely cautious in an evaluation of any treatment. On the other hand, the fact that he has used the method successfully for 19 years shows that there is real merit in it.*

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